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THE FOUNDRY

PUBLISHED MONTHLY BY
THE PENTON PUBLISHING CO.
CLEVELAND, OHIO.

ESTABLISHED 1874

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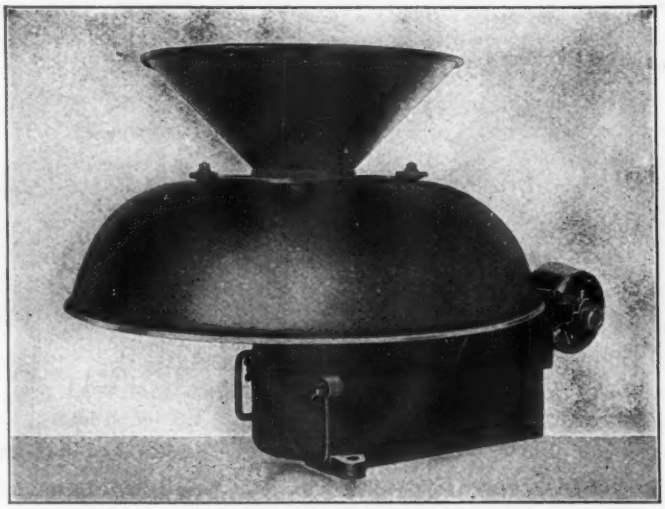

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THE FOUNDRY

Vol. 27, No. 2. *CLEVELAND, OHIO, OCTOBER 1905.* *Whole No. 158*

Foundry Department of the Port Huron Engine and Thresher Co., Port Huron, Mich.

Many tourists who have been up and down the Great Lakes have seen the long brick buildings of the No. 2 plant of the above-named company, just below Port Huron on the bank of the Huron river, and rising from behind the No. 2 plant can be seen the stacks of the No. 3 plant. The No. 1 plant, which is the original works, is located one mile from the other two properties, much nearer to the center of the city. This company had its origin in a small company making agricultural implements, which began business in Battle Creek, Mich., in 1874. Ten years later the plant was moved to Port Huron, and in 1890 the company was reorganized and the present name adopted. Since that time the business has grown rapidly, and many new lines have been added as the business grew. Today the principal lines in manufacture are traction engines, separators, wind stackers, plowing rigs, road-making machinery, heavy trucks for the transportation of material upon wagon roads using a traction engine as a source of power, corn harvesting machinery, hay presses, portable saw mills and other similar machinery. In addition to this they do a general jobbing line at their malleable plant covering all classes of small malleable castings.

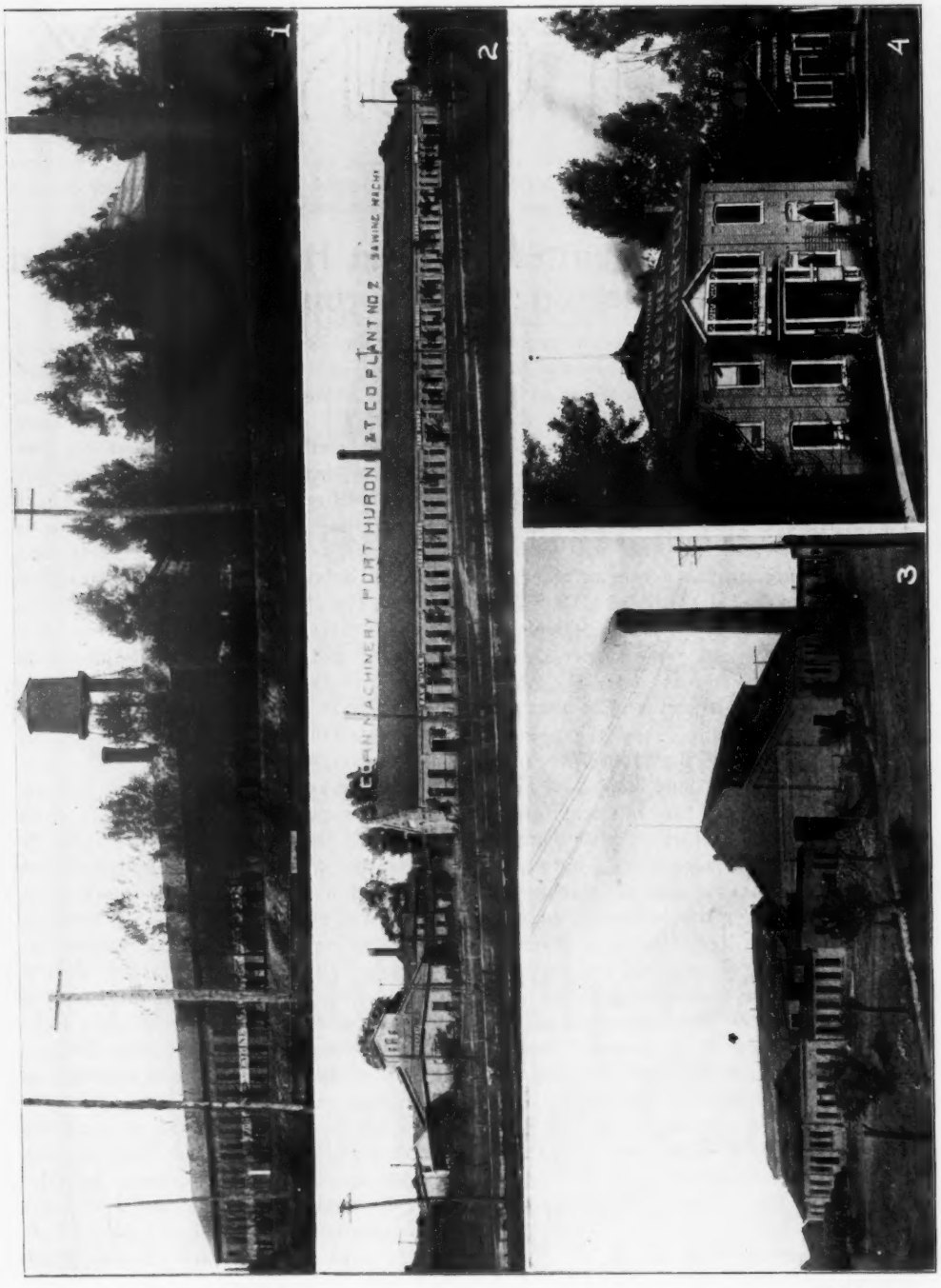
The foundry department is divided into three parts: There being two gray iron foundries—one is located at plant No. 1, the other at plant No. 2, and a malleable foundry at plant No. 3.

Foundry Plant No. 1.

This is the oldest of the foundries, and has grown until it now taxes the capacity of the building equipment to the utmost. The work is highly specialized, and hence special riggings have been devised for handling each class of work. The traction engine gears have to be tough and of good wearing qualities, and for this reason they are made of a 20 to 25 percent semi-steel mixture. These gears are molded on the floor and are poured in the ordinary manner. The metal mixtures are entirely controlled by chemical analysis and since this system has been adopted there has not been a single report of a gear breaking owing to a defective casting. Some years ago, when the mixtures were made by fracture, or from the chemical analysis, as reported by the furnacemen, there was a great deal of trouble due to breaking, and this led to a careful study of the conditions and to the final adoption of a semi-steel mixture, the ingredients of which are controlled by chemical analysis.

The company has no chemical laboratory, of its own, but has all of its work done at the Detroit Testing Laboratory, 60 miles away. When a new shipment of iron is received a sample is sent forward for analysis and none of the iron used until the analysis is received. This takes less than two days. In each heat a series of test bars are cast in pairs at different points in the heat. These bars are tested on a Reile testing machine at the plant. After the bars are broken they are drilled and a sample of the drillings sent to the chemist. If he discovers anything wrong in the mixture and feels that a change should be made at once, he calls up the foundry foreman by telephone the next morning before the charges for the cupola are made up, and this enables them to make any necessary changes. With the system now in vogue the gear castings in place of being the most troublesome part of the work that the foundryman had to contend with have become simple, ordinary castings, so far as difficulty in handling them is concerned.

One of the most interesting castings



1.—PLANT NO. 1. 2.—PLANT NO. 2, FOUNDRY AT LEFT. 3.—PLANT NO. 3, MALLEABLE FOUNDRY. 4.—GENERAL OFFICE AT PLANT NO. 1.

made at this plant is the drive wheel for the traction engine. These wheels are of peculiar construction, having two sets of spiral grooves, meeting in the center. The wheels are cast in a three-part mold, a half pattern being screwed or twisted from the mold with the aid of the crane. The spokes are made of wrought iron and the ends are fluxed with red lead so as to make them unite with the iron as it is poured. The iron has to be poured hot to make the spokes unite properly, and it has been

GRAY IRON FOUNDRY AT NO. 2 PLANT.

found necessary to pour the rims one day and the hubs the next, as this gives just the proper amount of tension in each spoke.

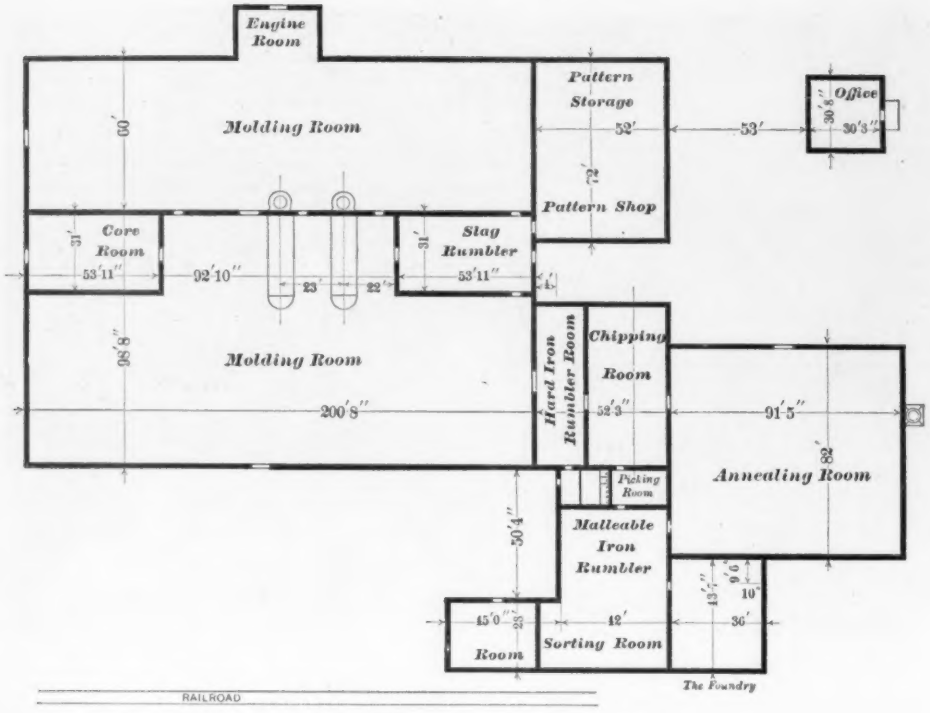
The foundry is equipped with jib cranes, fitted with pneumatic hoists, and also a trolley system for carrying the castings from the foundry to the machine shop. The trolley system was furnished by the Colburn Trolley Track Co., and is shown in one of the accompanying illustrations, with one of the large engine driving wheels suspended from the hoist. With the aid of this trolley system one man handles all of the castings from the foundry to the machine shop, where formerly several men had to be employed. Everything about the plant has been very carefully arranged so as to avoid duplicate handling to the greatest possible extent, and to secure the largest output with a minimum floor space.

Foundry Plant No. 2.

This plant is in connection with the works constructing the corn harvesting machinery, saw mills and several similar lines. As a consequence the castings are of an entirely different character from those required at the No. 1 plant. Much of the work is comparatively light, and molding machines are used as far as possible. In connection with the molding machines a special snap flask is used, having cope and drag slightly tapered so that the completed mold, when placed on the floor, has a uniform taper from the top to the bottom with

TROLLEY TRACK FROM FOUNDRY TO MACHINE SHOP.

1.—PLANT NO. 1. 2.—PLANT NO. 2, FOUNDRY AT LEFT. 3.—PLANT NO. 3, MALLEABLE FOUNDRY. 4.—GENERAL OFFICE AT PLANT NO. 2.



NO. 3 PLANT. MALLEABLE FOUNDRY.

the exception of the two grooves formed by the strips on the inside of the flask for holding the sand in place. The jackets are also made with a taper the same as the flasks. When the jacket is placed over the

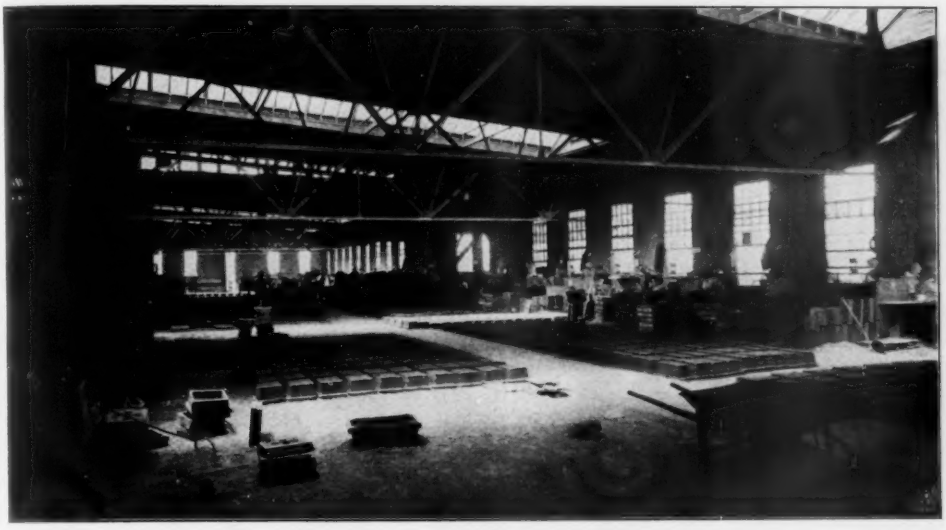
METAL PATTERN VAULTS.

mold it does not come in contact with the sand until the entire surface comes in contact, and hence there is much less liability of crushing or injuring the mold than in the system of forcing the straight jacket down over the mold. A tapered jacket also supports the surface of the mold much better than a straight jacket.

The larger molds are made under swinging jib cranes. There has been considerable discussion from time to time as to the best method of casting a cylinder about an iron or steel shaft. This is being done successfully every day in the No. 2 foundry. Special iron flasks have been made for the work and the piece is molded horizontally, the gate being formed in one end. After the mold is closed with the shaft in place the flask is firmly clamped and then lifted up on end in a pit prepared for it, the pouring being done from one end. This prevents the springing of the shaft as the hot metal rises about it, and the molder in charge of this work has the enviable record of a long series of successful molds without a single bad casting.

The foundry building at the No. 2 plant is 60 x 120 ft., with a cleaning room, 60 x 30 ft., at one end. There is also a wing containing the cupola, core department, storage bin, etc. The pattern storage is located in a two-story brick building, 33 x 61 ft., which is situated at one side of the foundry.

The core ovens at both the No. 1 and No.



ONE OF THE MOLDING FLOORS AT THE MALLEABLE FOUNDRY.

2 plants are of quite interesting design, and are so constructed that the various racks can be taken out so as to provide for the drying of any sized core within the capacity of the oven.

The large amount of careful thought which has evidently been spent in the design, the rigging and devices for use in the foundries of this company is, to a large extent, responsible for their financial success. This also emphasizes one of the reasons why foundries of moderate size can often produce better work and at lower prices than is possible in the case of large manufacturers employing thousands of men. For in the large manufactory the personal element of the management is lost, and as a consequence the percentage of spoiled work is always high.

Foundry Plant No. 3.

The No. 3 plant is devoted entirely to the manufacture of malleable iron castings. Like the other plants this one has its shop office located at the plant, and all of the general office work necessary in connection with the plant is carried on here. The office is situated in a building at the front of the plant proper. Following the work through the plant we come first to the metal pattern room, which is in a building immediately back of the office. This department is equipped for the manufacture of both iron and wooden patterns, including machine equipment, a molding bench and melting furnaces for testing metal patterns. Most of the malleable iron castings used by the company are of comparatively small size, and hence to keep the plant running to its full capacity it does a general jobbing business in small malleable castings, including a large variety of exceedingly intricate and difficult work. All of the patterns for this class of work are made in the metal pattern department. Adjoining the pattern shop on one side are the pattern vaults, of which there are 12. These are of brick construction, fire-proof and provided with iron doors. The general receiving room, between the metal pattern department and the vault, is shown in one of the accompanying illustrations, most of the doors in the vaults being closed. The wire screen shelves on both sides of the room are used for arranging the patterns when they are returned. As orders for work are received, the proper patterns are assorted out, ticketed and placed upon certain shelves. As the foreman in the foundry requires more work, he calls upon the men in charge of the storage room to issue to him a pattern together with the order tickets. When the work is complete the patterns are returned, inspected and, if not in good condition, immediately repaired before being returned to the storage. The metal equipment consists of two eight-ton air furnaces, which are used alternately. Ordinarily two heats per day are taken

1, HARD TUMBLING BARRELS. 2, SORTING HARD CASTINGS. 3, ANNEALING OVENS AND PACKING POTS. 4, SHAKING OUT POTS ON THE LEFT AND MACHINERY FOR CLEANING PACKING MATERIAL ON THE RIGHT. 5, BINS FOR RECEIVING HARD CASTINGS. 6, SORTING MACHINE FOR SOFT CASTINGS. 7, SOFT TUMBLING BARRELS.

from one furnace, all of the iron being carried to the floors in 40-lb. ladles. Air furnaces are located in the center of the foundry between two casting floors, each of equal area. At one side of the furnace is located the slag rumbler for cleaning the slag, and at the other end the core room and core ovens. All who have had experience in malleable work know that the handling, cleaning and annealing of small work is by far the most extensive part of the process, and in connection with this plant a very large amount of thought has been given to the simplifying of this process. As the castings come from the foundry they are put through a battery of four exhaust tumbling barrels in the hard iron tumbling room. When the castings are discharged from the barrels they are shoveled through openings on benches in the sorting room. Here they receive a rapid inspection and are assorted into general classes, each class being thrown onto an incline belt conveyor which conveys, and, at the same time, elevates the pieces to a series of automatic weighing machines in the annealing room.

These machines, after weighing the material, discharge it into bins in the one corner of the room. In the annealing room the pots are packed on the floor in front of the bins containing the castings; the packing material being located in an adjacent bin. When filled the pots are placed in the annealing oven in the ordinary manner and annealed. When cooled the pots are annealed and placed under a swinging crane which is used in shaking them out. When a section of the pot is swung over a hopper by the crane and packing material, the castings and all are allowed to fall into the hopper. Beneath this hopper is an automatic feeding device, which discharges the material in an ordinary revolving screen or trommel. The packing material passes through the holes in the screen while the castings are discharged from the end. The packing material is received on an incline conveyor, which elevates it to a shaking screen and removes the dust, and discharges the clean packing material into a car to be taken to the packing floor. The dust removed from the packing material is carted to the dump.

Returning to the revolving screen used for separating the packing material from the castings, we will trace the castings through to the shipping room. As the castings are discharged from the revolving screen they are received on an incline belt elevator, which delivers them to an incline shoot, which can be swung over any one of the soft tumbling barrels. When the castings have been cleaned in the barrels they are discharged into a hopper, which delivers them to another incline belt conveyor by which they are elevated to a bin above the assorting tables. The assorting tables are elevated and are surrounded with a series of shoots for delivering the castings to special truck boxes. By this device two men can assort more castings than a dozen could under the old system. After the truck boxes beneath the lower end of the shoots are filled they are tilted and wheeled to the inspecting tables. For dumping the boxes onto the inspecting tables, a special hoist is used which swings the boxes from the tables and inverts it at the same time, thus dumping the entire contents out before the inspector. As the castings are inspected they are placed in bags for shipment or into truck boxes for transportation to the different departments in either the No. 1 or No. 2 plants. The handling devices at this plant include all the arrangements from the hard iron cleaning room to the assorting room, which include the patents which have been applied for by Mr. G. F. Conner, who was formerly superintendent of the plant.

METALLOGRAPHY APPLIED TO FOUNDRY WORK.—IV.

BY ALBERT SAUVEUR.

The Photomicrography of Prepared Samples of Cast Iron.

In the preceding installments of this article I have briefly described the manipulations necessary to prepare samples of cast iron for microscopical examination as well as the needed apparatus. To conclude the technological part of my subject, I still have to outline the photography of the magnified images of the samples. The desirability of securing photomicrographs, and, therefore, permanent records, of the structures under examination needs not be insisted upon. The various steps once mastered, the operation becomes, moreover, a simple and inexpensive one.

Apparatus.—The camera shown in Fig. 1 as well as in Fig. 6 of the last installment (*The Foundry*, page 7, September, '05), gives excellent satisfaction. It is used vertically and if the microscope be always kept in the same position on the base of the camera, all that is needed when it is desired to take a photograph is to lower the bellows so that the light-proof connection it carries fits into a similar part attached to the tube of the microscope. Connection between the camera and the miscroscope is in this way quickly accomplished without disturbing in the least the specimen or the illuminating parts.

Manipulations.—The taking of a satisfactory photomicrography may be considered as dependent upon the following factors: (1) The polishing and other preparation of the sample, (2) the illumination of the sample, (3) the focusing of the magnified image upon the screen of the camera, (4) the kind of photographic plate used, (5) the exposure of the plate, (6) the development of the plate and other dark-room manipulations and (7) the printing from the negative, toning, etc. Unless each of these factors is given the correct value a satisfactory photomicrograph is not to be expected.

The preparation of the samples has been dealt with elsewhere and I shall only add

here that it is generally advisable to photograph a sample shortly after it has been etched, the structure being then generally more sharply defined and brighter. A slight rubbing of the polished surface over a piece of chamois leather just before placing it under the microscope also frequently brightens it and otherwise improves its appearance.

The other factors just indicated as influencing the quality of the photomicrograph will now be briefly considered in the order named.

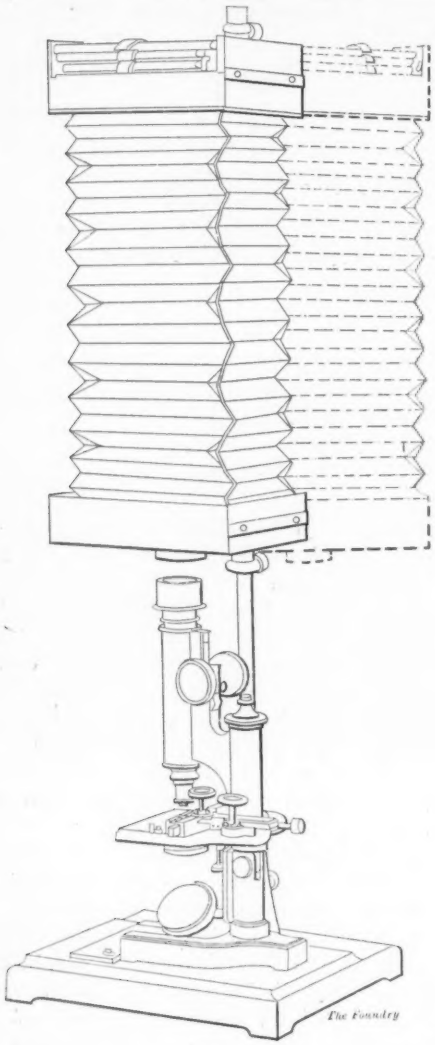


FIG. 1.

Illumination of the Sample.—Any of the illuminating apparatus described in the last installment may be used for taking photomicrographs but the arc lamp outfit is by far the most satisfactory. With a weaker source of light such as a Welsbach lamp or an electric incandescent lamp the exposure requires considerable time, even when using low power objectives, while it becomes objectionally long when using high powers. With high power objectives, moreover, the amount of light which reaches the screen, in case of a weak source of light, is relatively so small as to make a satisfactory focusing of the sample very difficult.

Whatever the source of light used great care should be taken to secure as intense and uniform an illumination of the sample as possible through suitable manipulations of the lamp, condensing lenses vertical illuminator, etc. The light-proof attachment should then be inserted and the bellows of the camera lowered as shown in Fig. 1, when the next step will be to focus the image upon the screen of the camera.

Focusing.—This is probably the most delicate operation connected with the taking of photomicrographs, and one which cannot slighted. Three conditions are essential to success: (1) The center of the image should occupy the center of the screen, (2) the image should be evenly lighted, and (3) it should be accurately focused so as to secure maximum sharpness and clearness. The image can generally be properly centered by a slight rotation of the disc of the vertical illuminator as well as by the rotation of the illuminator itself, while following with the eye the motion of the image upon the screen.

The absolute necessity of securing a perfectly even illumination of all parts of the image will be obvious and this is to be brought about through suitable manipulations of the parts affecting the path of the beam of light, that is the lamp itself, the condensing lenses and the vertical illuminator.

The image should be focused as accurately as possible by gently turning the fine adjustment screw of the microscope, and with the assistance of a focusing cloth. A focusing glass may be used with great advantage for this operation and is of special importance when photographing with high power objectives. It consists of a magnifying glass suitably mounted but an ordinary eye piece may be used with nearly as good results. This lens or eye piece should be placed on the plain glass circle which occupies the center of the screen of the camera, and the image carefully focused while being viewed through this lens. By this means we magnify the image and are therefore able to focus it

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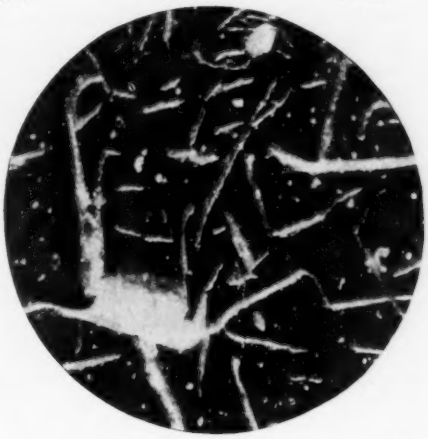

LOCATION OF SPECIMEN

REMARKS

		PHYSICAL PROPERTIES	CHEMICAL COMPOSITION
		TENSILE STRENGTH	TOTAL CARBON
MAGNIFIED	DIAMETERS	ELASTIC LIMIT	GRAPHITE CARBON
OBJECTIVE	EYE-PIECE	ELONGATION	COMBINED CARBON
EXPOSURE	PLATE	REDUCTION OF AREA	SILICIN
LIGHT	PAPER	TRANSVERSE STRENGTH	MANGANESE
DEVELOPER		CRUSHING STRENGTH	SULPHUR
ETCHING			PHOSPHORUS

FIG. 2.

more sharply in its finest details. Considerable light, however, is lost and the object will generally appear but dimly lighted. The rule to follow while using a focusing glass is to secure the clearest possible image while working the fine adjustment tentatively in both directions, bearing in mind that at its best, the image may appear blurred and dimly lighted.

When an electric arc lamp is used it is advisable to considerably reduce the light after focusing, by a partial closing of the iris diaphragm. In doing this we, of course, increase the exposure time, but as is well known a sharper negative is generally secured.

Kind of Plates.—While any good photographic plate may be used, I prefer the so-called "process" plate made by Carbutt, Seeds' "contrast" plates or other similar plates. They are generally relatively slow but they yield sharper negatives, having great contrast.

Exposure of the Photographic Plate.—After the image of the sample has been properly focused the sensitive plate should be introduced and exposed, with the ordinary precautions, for a suitable length of time. The time of exposure will vary according to (1) the kind of plate used, (2) the illumination and (3) the nature and color of the sample. The illumination will in turn depend upon (1) the source of light, (2) the adjustment of the illuminating parts and (3) the magnifying power and some other properties of the eye-piece and objective.

It is not possible to give positive information regarding the needed time of exposure. Each student must experiment a little before being able to judge accurately. As a guide and when using the relatively slow plates mentioned above, and a Welsbach lamp, it may be said that with low power objectives, yielding a magnification say of 100 diameters, the exposure will generally vary between five and twenty minutes, according to the character of the sample and the care with which the illumination has been adjusted. Higher powers required considerably longer time. With a more intense source of light such as that furnished by a 50-candle power incandescent lamp, and especially with that of an electric arc lamp, the time of exposure is, of course, much shorter, in the latter case varying from a fraction of a second to five or six seconds under the least favorable conditions.

Development of the Photographic Plate.—While any good developing formula may be used, my preference is for the old-fashioned potassium oxalate-ferrous sulphate developer, using six parts of a saturated solution of oxalate of potassium to one part of a saturated solution of protosulphate of iron. To retard the oxidation of the iron it is advisable to add a few crystals of tartaric or citric acid to the iron solution. The solutions should be mixed only as needed. The ordinary intensifiers and restrainers may be used in the usual way if the plate shows signs of having been under or over exposed, but I should advise the beginner to make another negative in case of decided ill-timed exposure, as probably the shortest road to success.

Printing.—Whether a printing out or a developing paper should be used for taking prints from the negatives is largely a matter of individual preference. Personally I prefer the former, but I am well aware that many favor some developing paper. Drying on ferrotype plates affords a quick means of finishing silver prints and giving them a satisfactory luster. It is recommended to cut the prints to circles some 2¼ inches in diameter by means of a margin trimmer and suitable form, as this will give them a very neat appearance.

Mounting.—The prints should be pasted on special cardboard mounts, such as is shown in Fig. 2, with descriptive matter and blank spaces to be filled. I also find it very useful to mount every print on index card, including the same printed and descriptive matter as that of Fig. 2, stamping upon each sample the same number as that of the index card and by keeping the samples in a suitable cabinet, any desired sample together with its photomicrograph and accompanying information may at a moment's notice be taken from the collection. Finally it is also advisable to print the same information and to mount a print on the envelopes or negative preservers in which the plates are kept. Such system greatly facilitates the work and adds to its effectiveness.

The Semet-Solvay coke plant of the Milwaukee Coke & Gas Co., Milwaukee, Wis., is undergoing extensive improvements to cost $13,000, at the completion of which the capacity of the plant in the matter of coke ovens, furnaces and other structures will be practically doubled.

NON-CRUCIBLE MELTING FURNACES.

Extract from a paper read before the Pittsburg Foundrymen's Association, Monday, Sept. 11, by Mr. W. S. Quigley, of the Rockwell Engineering Co.

It was but a few years ago that the molding machine stood in the same position before the foundrymen that the non-crucible using furnace does today, and the only reason that the oil furnaces, in the last four years they have been on the market, have gained such a prominent place in the largest foundries all over the world, is that the spirit of progress has now reached the foundry also, and many improvements are beginning to crowd out the antiquated methods and appliances so long in use there.

The non-crucible furnace is here to stay. It is an acknowledged success in hundreds of foundries and in intelligent and willing hands the Rockwell double chamber melting furnace in 95 out of 100 cases will make as good metal and castings and at a less cost than any other method extant.

Before going into details of the operation of the furnace, I wish to state that it should be understood that the results obtained in the operation of the Rockwell, or any other oil melting furnace which requires skill or intelligence in its operation, will naturally vary according to the ability of the operator, shop conditions and the cooperation of the foundry management and employes. Each varying condition contributes either to the ultimate success or failure of any such devices.

The fact that a great many furnaces of this class are being successfully operated in foundries all over the world is conclusive evidence that under proper conditions we can fulfill all of our claims, or as they say in New York, "we deliver the goods."

Occasional failures are made (if you don't believe it ask the crucible man), in some of which cases we cannot do the work satisfactorily, and in the others, we do not get the opportunity. It is both of these cases of conditions that I wish especially to speak about.

Where the work is very light—by light work I mean house hardware, such, for example, as that only 3-64 in. in thickness, lock parts and saddlery hardware, in which the loss in bad castings is ordinarily a

very large percentage—the oil melting furnace must naturally work to a disadvantage. The reason for this is that the transfer of the metal from the furnace to the ladle and then from the ladle to the molds, unless carried on under the most favorable conditions, requires so much time that the metal becomes chilled, and this results in an excessive number of bad castings. These bad castings may more than over-balance the saving of crucibles, fuel, waste in the ashes, etc. We may say, however, that one of the largest hardware manufacturers in this country is successfully using a Rockwell furnace.

The other condition is the most essential, as upon it depends the success or failure, but I do not hesitate to say that today, with the hundreds of oil furnaces in operation, but a small number of users of them are realizing the saving and benefits which are possible to obtain, and in few instances do the foremen or superintendents understand the operation of the furnace; preferring in most cases to depend entirely upon the furnace tender who can waste or save more money in a foundry than any other employe. Besides this fact very little attention is ordinarily paid to the furnace tender, and he is often discharged for some slight cause, and any other green man placed in his position. The management then wonders why the furnace is not working satisfactorily and finally condemns it.

Some foundrymen insist on pouring from the crucible, regardless of the fact that a clay-lined ladle, properly heated, is better and much more economical. It is not uncommon to have a user write us asking us to send them an expert, and stating that they cannot obtain hot metal or that the furnace fills with slag. Upon investigation our expert will report an insufficient air pressure, regardless of the fact that the printed instructions state that we require at least 12 oz. and that we furnish a gauge to insure their knowing the pressure. When these facts are pointed out, the chances are that the man in charge will state, "well we did have over 12 oz. when the furnace was started six months ago," or "the gauge got broke and how could we tell."

Another complaint may disclose the fact that, although our instructions caution the user to be sure and run the furnace at least one-half hour to warm up and to have it hot before any metal is put in, especially when light stuff, such as turnings, etc., are being charged, we find that the furnace is run perhaps 10 or 15 minutes and then charged, as they are either too careless or in too much of a hurry to wait for it to heat up. The result of such careless treatment is that it requires a long time to melt the charge, and this causes a very dirty furnace and lots of slag, as the chips and dirt adhere to the lining and are very difficult to remove. Then, too, at times the furnace tender does not attempt to clean the furnace by running it with mouth open downward after the last heat at night, as should be done and is done by all successful users.

To sum the matter up the most essential requisite to success in the use of furnaces of this class is co-operation and the regulation of shop conditions to meet the requirements of the furnace. This means that it should be so arranged that the metal can be taken rapidly from the furnace as soon as it is properly melted. An overhead trolley system facilitates this rapid handling very greatly. The molder should also be given a sufficient amount of sand and number of flasks so that he may continue to work until the heat is ready to pour. There should also be a sufficient number of hot ladles to provide for the carrying away of the metal rapidly.

Mr. Quigley then described the Rockwell furnace, which was described in this paper something over a year ago, and also quoted the results of a number of comparative tests, all of which show an advantage in favor of the oil melting furnace.

Jacob B. Simon has sold his interests in the A. Simon Brass Foundry Co., of Lansing, Mich., to James J. Carey. The firm will hereafter be known as the Gerson-Carey Co.

The Pennington Boiler & Foundry Co., of Pennington, N. J., has been incorporated for the manufacture of steam and hot water heaters. The incorporators are: Thos. T. Burchfield, of Philadelphia; Frank F. Glenn, of Philadelphia, and Joseph Sheeler, of Pennington.

The Miners' Foundry & Supply Co., of Carterville, Mo., has been incorporated with a capital of $50,000. Among the incorporators are: W. B. Kane, Chas. P. Wallace and A. R. Lively.

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CONTENTS.

Foundry Department of the Port Huron Engine & Thresher Co..... 52
Metallography Applied to Foundry Work. 59
Non-Crucible Melting Furnaces..... 62
Trade Outlook 64
Meeting of the British Foundrymen's Association 64
John Fritz on Education..... 65
Types of Air Furnaces..... 67
How Some People Learn..... 69
A High Melting Ratio by Accident..... 69
The Foundrymen's Patternmaker..... 70
Steel Castings and the Constitution of Steel 72
Gating Malleable Castings 76
Cost Keeping for the Foundry..... 79
Book Reviews 84
How Pete Cady Bucked the Trust 85
Second Annual Meeting of the British Foundrymen's Association 88
Associations and Societies 94
A New Type of Metal Sawing Machine.. 96
Trade Publications 97
Cast Iron Notes 98
Brass Foundry Notes 99
Metallurgical Notes 99
Personals 102
Deaths 103
Fires 103
New Construction 104
General Industrial Notes.....105

TRADE OUTLOOK.

During the past month foundry matters have run along in a very smooth manner without much change, either in tonnage melted or in iron prices. There is something of a tendency, however, toward rather stiffer prices for pig iron, and a number of valley furnaces will not sell iron below $15 for No. 2 foundry, while in the South a number of pig iron manufacturers are holding for $12 per ton for No. 2. There are a number of large melters who are figuring on heavy tonnages for next year's supply, and it is probable that in the near future considerable iron will be sold for 1906 delivery. There is a scarcity of foundry iron in the Chicago district, and iron is being shipped from Cleveland and other industrial centers to Chicago. To meet the demand for more pig iron three new blast furnaces are to be constructed in Chicago and, it is reported, that one more will be built in Cleveland.

The steel foundries still report a very large number of orders on hand and plants operated to their full capacity. The same report comes from most all the malleable plants. There seems to be an improvement in the heavy gray iron work, and there are reports of some additional foundries starting up, additional contracts being secured by others which will result in the operating of some plants on a more extensive scale than has been necessary during the past few months.

The coke market continues strong, and Connellsville foundry coke is quoted from $2.45 to $2.60, f. o. b. ovens.

MEETING OF THE BRITISH FOUNDRYMEN'S ASSOCIATION.

A year ago a British Foundrymen's Association was organized, and on Aug. 7, 8 and 9, of this year, they held their second annual meeting, an account of which is given in another part of this issue. We are indebted to Mr. A. C. Meyjes, editor of the *Ironmonger*, of London, for sending us the report promptly after the close of the meeting and before it appeared in his paper, but unfortunately *The Foundry* went to press on the 15th of August, and hence it was impossible for us to get any notice of the meeting in for that number.

We are sure that everyone who has the

cause of foundry practice at heart will certainly feel glad that our British cousins are making such progress with their organization and that the organization bids fair to be of great benefit to the foundry industry.

Some of the remarks, concerning the difficulties of interesting the average manufacturer in such an organization, and convincing him that he should be represented at the convention, reminds us a good deal of the experience in America, but the persistent conscientious work of those connected with the organization in this country has resulted in great good to the foundry industry, and we feel sure that the officers of the new British association will meet with some degree of success.

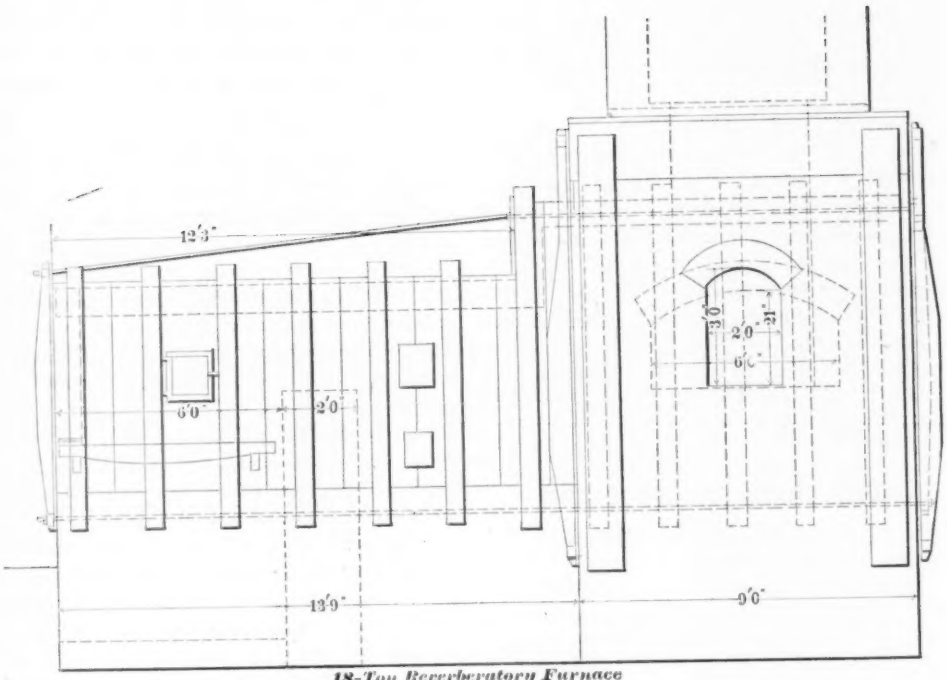
JOHN FRITZ ON EDUCATION.

In an interview in the Manufacturers' Record, John Fritz says:

"If I were a younger man I should seek to establish a large iron plant, and in connection therewith establish a first-class school provided with the very best equipment in buildings and teachers, getting the ablest principal without regard to the amount of salary to be paid. In this plant I would require that the boys of every family employed there should attend school, either night or day, for about two and one-half hours a day, and for the balance of what is coming to be the working day or eight-hour shift in iron works, they should be put into the shops or some department with the opportunity to become good all-around mechanics and practical men. Throughout the country there is a tendency to overeducation in the sense of too much effort at book learning, with no practical knowledge that fits a boy for earning an honest living and making an independent man of him. In the high schools of our country we are largely unfitting boys for the real work which gives them the opportunity of independence and self-reliance and mastery of a trade with the possibilities of unlimited advancement before them. Of dry goods clerks and politicians and shyster professional men we are turning out a surplus, but of men who can run a machine shop, of good mechanics of all kinds, there is a growing scarcity, and yet the mechanic, more independent than any other class of people in the world unless it be the farmer, and even in many respects more independent than the best of farmers, as he neither has to depend upon sunshine or rain, wind or calm, earning from $3 to $6 a day, is in demand everywhere. Advertise for bookkeepers and dry goods clerks and you have a surplus begging for a job; get slightly injured in some railroad accident and you will be beset by lawyers seeking a chance to bring suit; but advertise for men who can do things, for the old-time, all-around mechanic, and you almost seek in vain. In the works which I have in mind, and which I should like, if a younger man, to establish, I would seek to so watch and develop the boys growing up in the school and in the shop as to secure superintendents and managers from among them. In all of my experience, and to me the most satisfactory part of life as I look back over it is that which has had to do with the training or the helping to create real men, such as D. A. Tompkins of Charlotte, who was one of my 'boys,' though he came to me from a technical school and not from the shop, and many others who rank in the world of business as he does. And I found them in the shops and among the water boys, and by studying and watching their abilities put them in positions in which they could not only become important factors in the success of the enterprises with which I was identified, but important factors in the world's affairs. It would be possible to build a modern plant managed along these lines and practically defy the competition of the world."

A HIGH MELTING RATIO BY ACCIDENT.

Since making up the portion of the paper containing John Ricketts' article on "A High Melting Ratio by Accident," a letter has been received from Mr. Ricketts in which he states that he is sure that the weights given in the article are accurate. He also states that he is particular about the melter putting in the right amount of coke as he has observed that putting in too much retards the melting. In one case where 50 lb. of coke too much was placed between the charges it took an hour longer than usual to run off the heat. This is certainly an interesting example of what a cupola will sometimes do in an emergency.



18-Ton Reverberatory Furnace

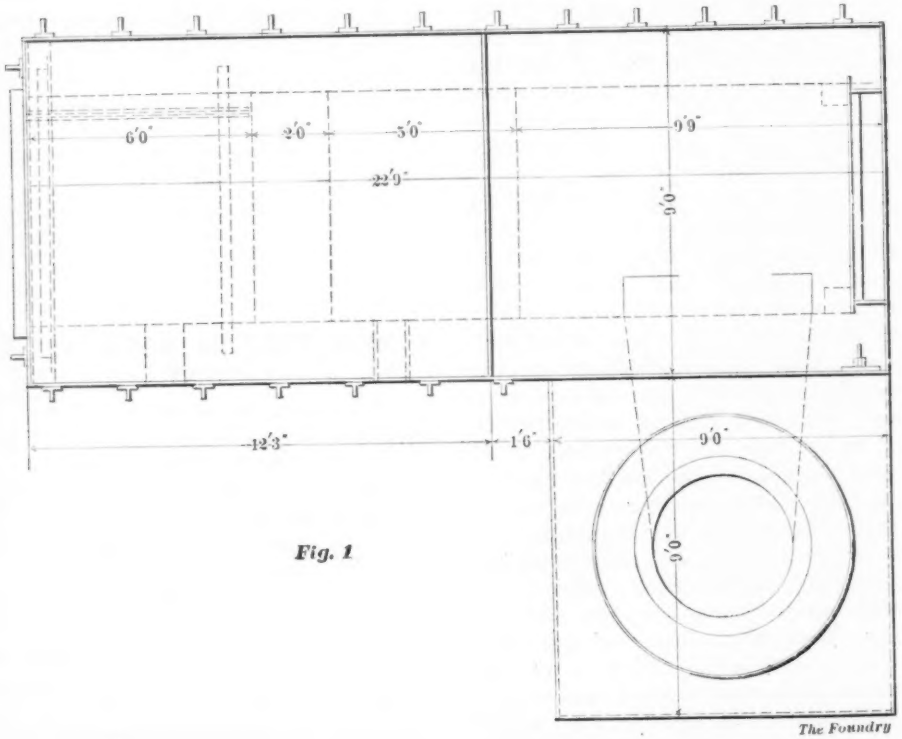


Fig. 1

The Foundry

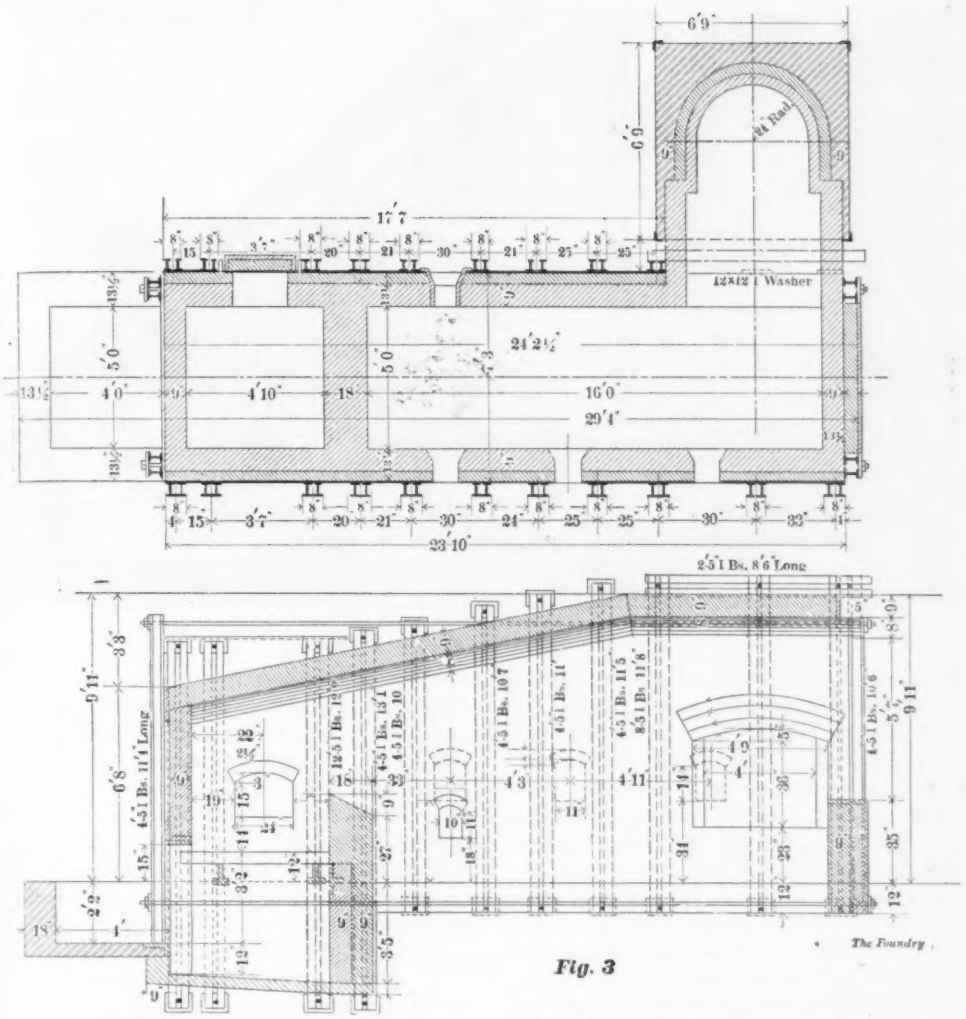


Fig. 3

TYPES OF AIR FURNACES.

BY L. G. BLUNT.

The three principal types of air furnaces in use in this country are the Pittsburg, the camel-back, which somewhat resembles a few English furnaces, and one that was built by the Westinghouse Foundry Co. at Trafford City, Pa. The principal difference in them is in the shape of their roofs.

THE PITTSBURG TYPE.

The Pittsburg furnace, as may be seen in Fig. 1, has the same cross-sectional area from the back of the fire box, to a point about two-fifths of the distance from the bridge wall to the front of the furnace. At this point there is an enlarging off set of from nine to eighteen inches in the roof, extending to the end of the furnace.

The flue and stack are usually placed on the side of the hearth and in line with the front. The charging door is placed in the end. The flue is about fifteen or eighteen inches high.

THE CAMEL-BACK TYPE.

The camel-back furnace as shown in Fig. 2 has a slightly increased cross-sectional area from the back of the fire-box to the bridge-wall from this point to the middle of the furnace it increases much more rapidly.

The roof in the forward part of the furnace follows the same contour as in the rear, the flue and stack being similarly shaped and placed as in the Pittsburg furnace. The charging door is in the center of the side opposite the stack.

THE WESTINGHOUSE TYPE.

The Westinghouse furnace, Fig. 3, may

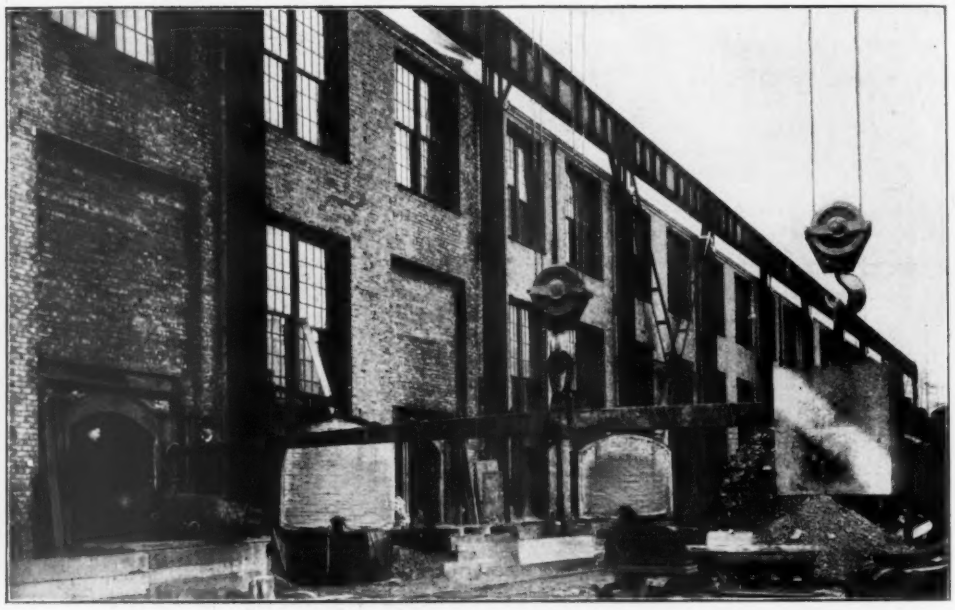


FIG. 4. TEN TON CHARGING BEAM.

be called a combination of the two former. Its cross-sectional area increases from the back of the fire box to a point about two-thirds the length of the furnace. From there to the end it has the same section.

The flue and stack are placed on the side as in the others, but the flue is much higher, with the same width.

It cannot be said that any one of these furnaces has the advantage over the other in the quality of iron that is taken from them, but there is a marked difference in the fuel consumption and the ease in which they may be charged.

In the first two a melting ratio of one pound of coal to four of iron is about the best practice, where a ratio of one to five can be attained in the latter.

The difference in fuel consumption is due to the manner in which the shape of the furnace facilitates the combustion of the volatile gases. This may be seen by an analysis of the theoretical formula for the flow of fluids through conductors: $Q = AV$. When Q represents quantity, A the area of a given cross-section, and V the velocity at that point, it is necessary to keep V constant, so that the proper time contact is maintained. Q is variable as is seen in Boyle's Law.

A perfect gas under constant pressure expands 1-273rd part of its volume for every degree rise in temperature C. Then to keep V constant it is necessary to have A variable. The Westinghouse furnace is built with the idea of keeping V constant by having the cross-section increase gradually from the back of the fire box to the point shown in the diagram. It was not thought practical to enlarge it further.

The camel-back furnace is designed with the same idea, up to the center, but from this point on V cannot be constant. In the Pittsburg type V is not constant in the first part of the furance.

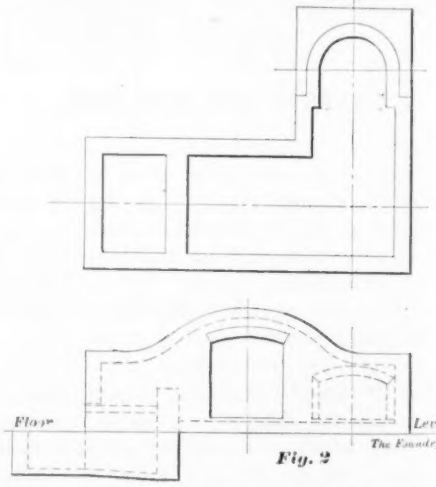


Fig. 2

This is the reason for the high melting ratio obtained in the Westinghouse furnace.

It also has an advantage over the others in the ease in which it may be charged. The camel-back furnace can only have its charging door on the side, which necessitates turning a large portion of the scrap after it has entered the door. The only advantage it has over the Pittsburg type is that its roof over the back of the hearth is a little higher.

The Westinghouse foundries have done away with the pinch bar and roller by substituting a ten ton charging beam, operated by a fifty ton yard crane. A cut of this beam may be seen in Fig. 4. This article will be followed by one on the operation of these furnaces.

HOW SOME PEOPLE LEARN.

BY JOHN DOYLE.

The writer noticed in the *Ruthless Rhymes* in the August number, the following:

A helper too near the cupola strayed,
He wanted to see how iron was made.
He didn't know hot iron would burn;
Isn't it strange how some people learn.

This certainly reminds me of the way some other fellows learned and brings to mind a foundry experience. At the close of the Civil War there was a large amount of cannon shot and shell sold for scrap, and a small foundry located in the region over which the armies had swept, gathered a rich harvest from the surrounding battlefields which was collected and brought in by the natives for a very small price. For a number of years everything went smoothly and the boss was congratulating himself on the important saving which he was effecting by the use of all this cheap scrap.

It was the duty of the melter to see that all shells were unloaded before they were charged in the cupola, and his orders were faithfully carried out for a number of years. Finally the supply of scrap iron from the battlefields commenced to grow less and only an occasional load was brought in. These were always more or less rusted and it was difficult to remove the plugs and primers from the shell. At last a 6-in. shell came in which could not be opened easily, and after it was kicked around the yard for some time, the melter had gotten very familiar with it and came to the conclusion that that little piece of scrap iron surely could not hurt anybody, and at last, in a curious moment, he charged it in the cupola just to see what it would do.

He had such faith in his cupola that he took his station at the tap hole as usual, and everything went smoothly for some time. He finally stopped the cupola and backed up against the shell near the spout to wait until it was time for another tap. Just about that time the shell woke up, took out a four-foot section of the cupola lining, and pelted bricks, coke and scrap iron all over the foundry. As luck would have it, the melter was so close to the cupola that most of the material went over him, and except for a few bruises, he was none the worse for the racket when dragged out by the rescuing party after the damage was over. Some of the poor fellows out on the floor did not fare quite so well, and two of them who stopped pieces of that shell were added to the casualty list of the Civil War, even though peace had been declared four years before. The old shack of the foundry was set on fire and partially destroyed in addition to the damage done to the cupola. Incidentally, we may say that the melter learned what a shell would do.

A HIGH MELTING RATIO BY ACCIDENT.

The following was received in a letter to the editor from John Ricketts, and may be of interest to other foundrymen. While we do not know that the melter did not put in a few extra forks full of coke without recording it, it is, nevertheless, evident that the melting ratio was exceedingly high, and Mr. Ricketts states that he was very glad to have it come out all right and certainly would not attempt to use such a ratio as a regular thing.

"There was recently a mistake made in charging a 48-in. cupola in our plant. The foreman of the melting stage men was off for a day and so one of the others took his place. As they had all worked on the stage before and were familiar with the charging of the cupolas I did not expect any trouble. When the cupola was ready for charging I told the men the amount of coke to put between the charges and went below to put in the breast. While I was below they filled up the cupola to the charging door. He was expected to put in 3,000 pounds of iron upon 300 pounds of coke for each charge. What he actually put in was as follows: Coke in the bed 1,200 pounds; iron on the bed, 6,000 pounds. This was followed by two charges, each of which consisted of 300 pounds of coke and 6,000 pounds of iron; making 18,000 pounds of iron to 1,800 pounds of coke. The balance of the charge was put in correctly—that is, 300 pounds of

coke to 3,000 pounds of iron until we had 26,000 pounds of iron and 2,700 pounds of coke in the furnace. We got the metal out all hot enough to pour off the work. When I was told the mistake I came to the conclusion that the only way I could get the heat out was to keep the bed up, so I let it fill up with iron to the tuyeres every tap, thus causing the metal to have a tendency to float the coke and giving me the full benefit of the bed. I did not open the slag hole until after the 18,000 pounds of iron had all been tapped out, for I was afraid to spare a pound of coke and was in hopes that the slag would also help to float it. I believe more can be learned about cupola practice from mistakes and bad practice than in any other way, and that if these mistakes were more often described, better work could be done, as the melters could then compare notes on their work. The writer would like to know if any one else has ever had a similar experience."

THE FOUNDRYMAN'S PATTERN-MAKER.

Unfortunately the foundry foreman does not always have the power to dictate as to the manner in which he would prefer having a pattern constructed, in order to be able to make the castings in the most economical way. Whether this fact is due to a lack of ability on his part, or a desire to get along smoothly with the pattern department, or the short-sightedness of the managers in placing these questions entirely in the pattern foreman's hands, I do not know. But it is a fact nevertheless, that in the majority of cases where a question arises as to the best way to make a pattern, the pattern foreman has his way. And the man in the foundry must produce good castings cheap, and be responsible for results obtained, while working contrary to what his own practical experience teaches him is the safest and cheapest way.

The successful patternmaker is not always the one who has the molding trade down "pat," and is able to explain to the managers the cause of the many failures that attend the foundry foreman's efforts. Neither is the patternmaker who submits a gratifying low cost report to the managers, always making money for the company. It is true that some patternmaker foremen are able to produce good patterns at a lower cost than others, by studying economy in the method of constructing moldable patterns. Such men are valuable. But the man that cuts his pattern making cost at the expense of the foundry, is a costly person to have around.

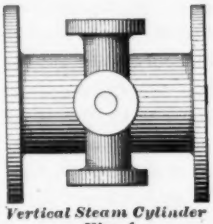
Poor patterns produce poor castings. Two flanges and a straight edge do not constitute a pipe pattern, and although it would not cost but a few cents in pattern, making it is expensive and increases the percentage of loss in the foundry in bad castings at least 70 percent and decreases the output 75 percent.

Another expensive patternmaker foreman is the one with a hobby. Patternmakers like molders have hobbies or certain pet theories that they believe to be the best, and to have been the cause of their success in the past, which in many cases is true. It is only when the patternmaker's hobby is a certain method in the foundry where he has had no practical experience, that it becomes a nuisance and a drawback to the foundry. For instance, he may have been very successful in a certain class of work by constructing his pattern in such a manner as to make it necessary to use dry sand cores to form every flange, lug or opening that probably could be made in green sand, and owing to his limited experience in molding he is convinced that dry sand cores are a strict essential to successful molding on all classes of work. And he continues to nail on core print and make core boxes where green sand would be safer and cheaper. This man, if allowed to work along these lines, regardless of the foundry foreman's wishes, loses sight of everything but his hobby (dry sand cores), and on receipt of a new drawing, the first thing he will look for will be where he can introduce his dry sand core.

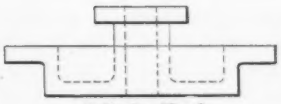
On the other hand, we have the patternmaker's hobby just the opposite, green sand cores, loose lugs, and drawbacks, these things, if practiced by one without practical knowledge of molding are often the result of many bad castings and a high labor cost in the foundry.

When I say practical experience in the foundry, I mean one who has served his apprenticeship on the floor and has learned by daily failures and successes the many small details that govern the results obtained. No one can fully understand these things or learn them by observation. Hence we must not presume to use the patternmaker's ideas to operate the foundry, in preference to the practical foreman and molder.

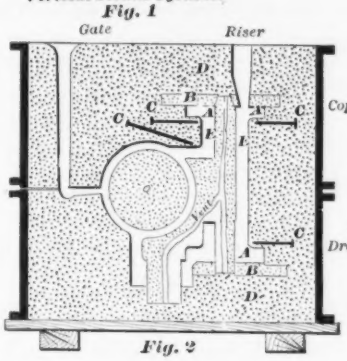
A foundry foreman should be more com-

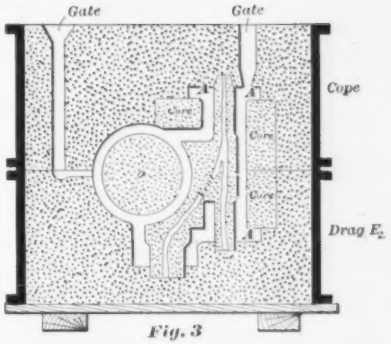


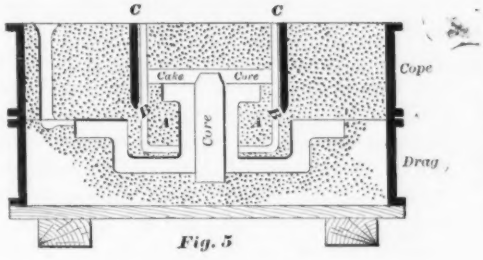
Vertical Steam Cylinder
Fig. 1

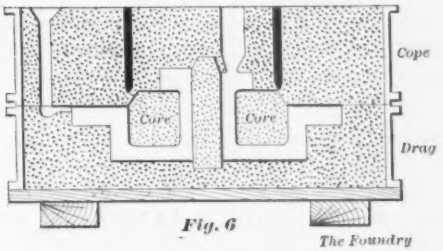


Cylinder Head
Fig. 4









The Foundry

petent to determine what the proper method of molding a job is than the patternmaker foreman.

The successful patternmaker always consults the foundryman before starting to build a pattern of any importance. He may not make the pattern just like the foundryman wants it, but he will have the foreman's ideas and his own to work on.

Fig. 1 represents a small pump cylinder.

Fig. 2 gives us a sectional view of the mold of the same when molded with a pattern constructed by the loose lug, drawback, and green sand core patternmaker.

The two flanges shown at A are loose on the pattern and draw out when the flask is half rammed up and the cavity covered with a covering core, shown at B. On making the mold this way it is necessary to lay in a great many spikes or rods, indicated by the letter C, to carry the green sand under the flanges A. There is always much danger of a scab or cut at this point, see letter E, or a drop above the flange in the large part of the mold. The covering core B makes it very difficult for one to ram the cope hard enough to carry without dropping out on account of the danger of the rammer, or the pressure of the sand breaking it, and spoiling the flange. It is also a hard job to keep the loose sand from dropping into these flanges while the pattern is being drawn, and very often results in a dirty casting.

Another objection is the danger there is of getting these loose flanges rammed crooked or spread too far apart. All these items are to be considered, which run up the cost of molding beyond reason.

The proper way and the most economical way to make this pattern is shown in Fig. 3, which is a sectional view of the same cylinder. In this case the flanges A and A are formed with a dry sand core, which makes the cost of molding 75 percent cheaper than when molded as shown in Fig. 2. In this case there is no labor required in laying rods.

No drop out on account of soft ramming over the covering cores. No dirt in flanges. No possibility of flanges being too far apart. Besides there are other advantages. The dry sand cores have a tendency to obviate the chance of a leak under the flange caused by shrinkage, etc.

This pattern can be quickly and cheaply put on a molding machine, or it is a plain job and can be made by an apprentice boy.

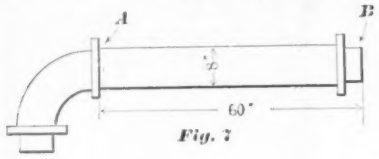


Fig. 7

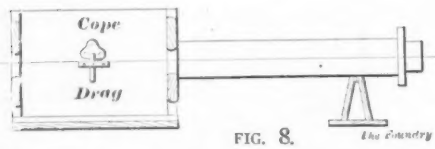


FIG. 8.

I have had an occasion to alter several patterns of this kind much to the distress of the patternmaker foreman, and have been able to get six good castings for the same money I paid for one the old way.

Fig. 4 is a rough sketch of a cylinder head.

Fig. 5 is a sectional view of the old fashioned method of molding the same. The same trouble is experienced in making this mold as in with Fig. 2, and the purposed remedy is shown in Fig. 6.

In these two cases the green sand core patternmaker would be an expense to the foundry. While the dry sand core man would be in his element.

Hence it is not possible for the patternmaker to be a success without the help of foundry foreman.

Now I want to talk about the cheap patternmaker. He is the fellow who turns out a large number of patterns with a very small force of men. Fig. 7, which is a sketch of one of his 10-in. elbow patterns, gives us an idea how he does it. Fig. 8 shows how the molder must work in order to use the pattern.

The above are but a few examples of what the foundry foreman must contend with. The most successful foundryman is he who has the pattern department absolutely under his control. This has been proven in several instances, beyond a doubt. It has also been proven that many patternmakers, who have aspired to the position of foundry superintendent have been a complete failure in that capacity, although while working under the orders of a competent foundryman they were a valuable assistant. The writer does not mean to belittle the patternmaker, or to make him appear as one less intelligent than the foundryman, but the conditions are altogether different, which gives the foundryman the advantage.

It is true that some of the most advanced ideas in foundry practice originated in the patternmaker's brain but required the peculiar instinct of the practical molder to carry them out successfully.

PAUL R. RAMP.

STEEL CASTINGS AND THE CONSTITUTION OF STEEL.

BY PERCY LONGMUIR.

Average steel castings, whether of surface blown Bessemer or open hearth metal, usually contain about 0.35 percent carbon, and in castings this element rarely exceeds 0.5 percent. The higher the content of carbon the greater the tensile strength—within certain limits—but this increase in tenacity is always accompanied by a loss of ductility. As ductility usually figures on all specifications tenacity alone is useless. Generally an elongation of from 15 to 20 percent on 2 inches and a bending angle of 90 degrees is specified. A serviceable composition to meet the foregoing is as follows: Carbon, 0.3 percent; manganese, 0.8 to 1.0 percent; silicon, 0.2 percent, with sulphur and phosphorus as much below 0.08 percent as possible; from which it will be noted that with the exception of graphite, steel castings contain the same elements, though in different proportion, met with in cast iron. Carbon gives rigidity, manganese and silicon both assist in the production of sound castings, whilst sulphur and phosphorus are decidedly harmful. A general limit of manganese is found in a content of 1 percent, and silicon

TABLE I.

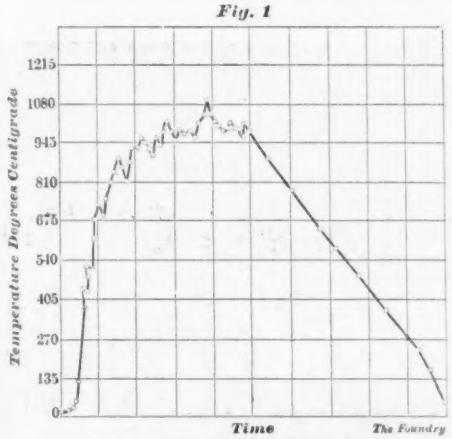
Carbon.	Silicon.	Manganese.	Sulphur.	Phosphorus.	Max. Stress Tons per sq. in.	Elongation % on 2 inches.
0.29	0.07	0.16	0.07	0 06	23.7	10.0
0.29	0.14	0.92	0.06	0.02	30.9	7 5
0.20	0.04	0.38	0.15	0.06	18.2	4.1

should not exceed 0.4 percent, but these limits will naturally vary with the class of work. The figures in Table I illustrate the influence of manganese and sulphur.

These values are obtained from unannealed castings and the first two show that with the same carbon but an increase in manganese of from 0.16 to 0.92 percent maximum stress is raised from 24 to 31 tons without a serious decrease in extensibility. The third example illustrates the influence of 0.15 percent sulphur and with this steel no form of heat treatment and no type of annealing would raise the extension above 10 percent. Had the manganese been 1 percent instead of 0.38 percent by suitable annealing an extension of 20 percent could have been obtained. Evidently then manganese in steel as in cast iron, neutralizes the harmful effect of sulphur. This is owing to the fact that manganese sulphide has a much higher freezing point than iron sulphide. Thus on cooling, manganese sulphide solidifies early and its contraction is soon complete, further cooling and contraction tending to wedge the solidified globules of sulphide firmly in between the other constituents of the steel. Hence manganese sulphide occurs in isolated areas and owing to the pressure in a more or less globular form which does not destroy the continuity of the mass. On the other hand iron sulphide solidifies comparatively late in the cooling process, hence as the mass is cooling this still liquid sulphide is rejected by the solidified portions of their boundaries. Further cooling results in the solidification of the iron sulphide and its contraction. Therefore owing to late solidification and contraction, cohesion is seriously impaired. To this weak cohesion must also be added the fact that a brittle compound is distributed through the mass of the steel in a more or less connected form. No matter how thin this meshwork of iron sulphide may be—it most effectually destroys the continuity of the whole. As the strength of a chain is represented by that of the weakest link so the strength of a steel containing iron sulphide is represented by the cohesion between the sulphide and the other constituents of the steel.

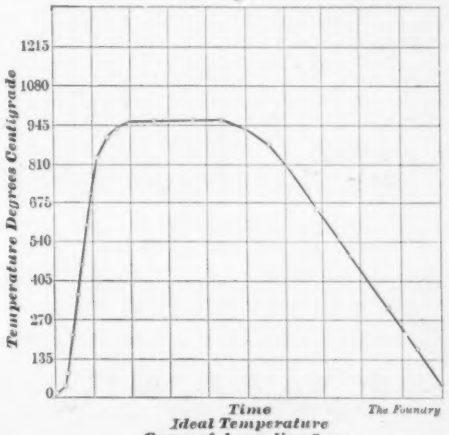
Turning to the effect of carbon the following tests are taken from annealed castings and from bars cast on commercial castings:

Fig. 1



Temperature Curve of Annealing Oven
Total time including Cooling
95 hours.

Fig. 2



Ideal Temperature
Curve of Annealing Oven.

Carbon %	Max. Stress Tons per sq. in	Elongation % on 2"	Reduction of area %
0.08	20.0	40.0	60.0
0.28	28.0	33.5	45.6
0.51	35.4	22.5	27.3

These results were obtained from surface blown Bessemer steel, and are for cast annealed metal decidedly high, being almost equal to forged steel, except in the one property of resistance to shock.

Notwithstanding the present tendency to shorten annealing time the writer's experience convinces him as to the value of a long anneal, and results such as the foregoing, which are regularly obtained, testify to the practical value of thorough annealing.

Annealing therefore determines the final properties of any steel castings, and to be successful it involves both time and temperature. The object is a two-fold one involving structural charges and the relieving of internal strains due to inequalities in the section of the casting. The latter is of much

moment and in the case of an intricate casting containing heavy and light masses of metal in juxtaposition careful treatment is required.

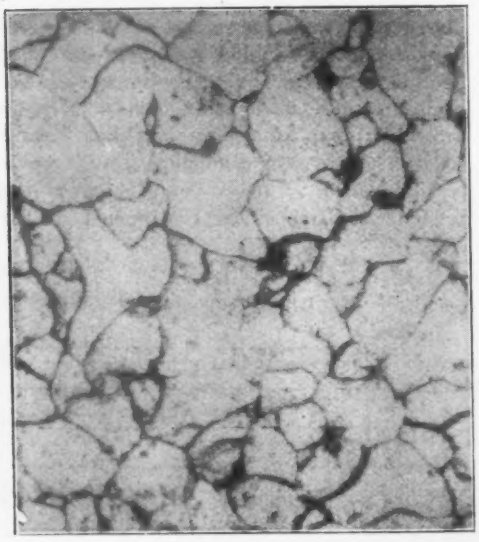


FIG. 3.—IRON CONTAINING 0.08 PER CENT CARBON. TYPICAL FERRITE MAGNIFIED 360 TIMES.

Unless this is given an unannealed gray iron casting will under certain conditions prove of greater value under service conditions.

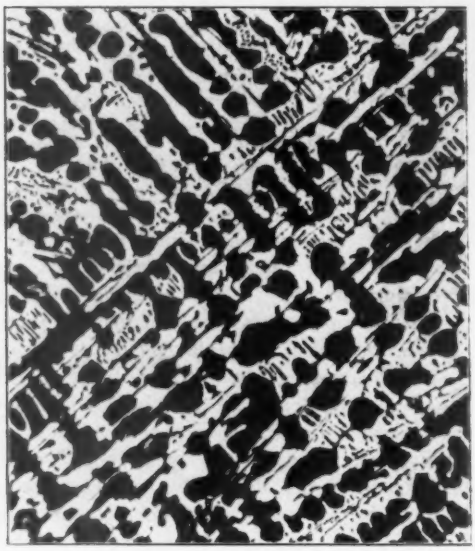


FIG. 4.—WHITE CAST IRON CONTAINING 3.4 PER-CENT COMBINED CARBON, PEARLITE AND CEMENTITE MAGNIFIED 150 TIMES.

A steel casting unrelieved of its contraction strains is a source of danger and given the right conditions the castings will fly. Therefore the cooling down from the annealing temperature must be slow and the slower the better the final result.

For castings containing from 0.3 to 0.5 percent carbon, a suitable annealing temperature is found between 900° and 950° C., and a suitable time at this temperature is found in three full days (72 hours).

A temperature record of an annealing oven is shown in Fig. 1. The dots represent temperatures—photographically recorded at intervals—of two hours, and this particular record is given in order to show the wide variations which may occur. The ideal record would be that of Fig. 2, in which the temperature steadily mounts, is evenly maintained, and then slowly falls. It need hardly be added that the nearer the actual curve to the ideal the better the final product. The steady fall of Fig. 1, on completion of firing, will be noted a feature which tends to equalize any inequalities in the thickness of the castings.

FIG. 5.—PEARLITE MAGNIFIED 1,000 TIMES.

The structural changes induced by annealing are to some extent associated with the constitution of steel, and a few notes on this question are not out of place in considering steel castings. As already noted steels contain the same elements, but in different proportions, met with in cast irons. The only exception is that of graphite. Owing to the total content of elements other than iron being low it naturally follows that metallic iron

is high. Reference to the tests given will show that an iron containing 0.08 percent of carbon is exceedingly ductile, being in this respect practically equal to copper. The addition of carbon to this ductile iron raises the tensile strength and lowers the ductility according to, within limits, the extent of the addition. This effect is due to the action of

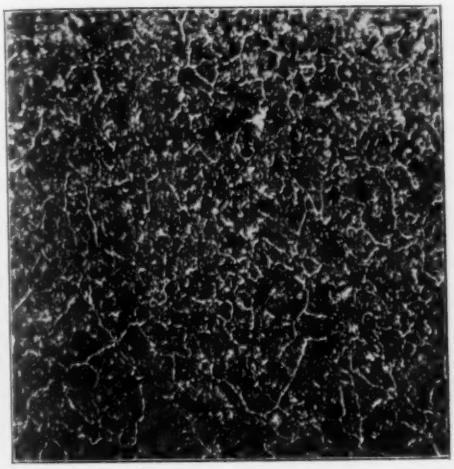


FIG. 6.—STEEL 1.2 PERCENT CARBON. PEARLITE AND CEMENTITE MAGNIFIED 150 TIMES.

carbide of iron and not carbon alone on iron. In all steel castings the carbon is in combination with iron as a definite carbide Fe_3C.

This carbide is hard and brittle and if present in sufficient quantity gives the glass hard product white cast iron, corresponding to about 3 percent carbon. The best way of studying the distribution of carbide is by means of the microscope, which, given a suitably prepared section at once reveals the internal arrangement of the steel under examination.

The iron containing 0.08 percent carbon when so examined is found to possess the structure shown in Fig. 3, the lines of which represent crystal boundaries and the dark knots show the distribution of the relatively small amount of carbon present. The white crystals of iron are for convenience termed "ferrite," and the dark knots are termed "pearlite." Taking as the other extreme a white cast iron containing 3.4 percent combined carbon, its structure is that reproduced in Fig. 4. Here the increase in volume of the black areas of pearlite faintly shown in Fig. 3 will be noted as also the appearance of a new constituent which represents the hard carbide of iron, known as "cementite." Figs. 3 and 4 are given first in order to introduce the three constituents of ferrite, pearlite and cementite.

Ferrite is essentially ductile and soft, whilst cementite is exceedingly hard and brittle. Pearlite is a mixture of ferrite and cementite. Although in the two photographs given it is figured as a structureless substance, it is nevertheless at higher magnifications resolved into the two constituents indicated. In annealed steels pearlite is found in a laminated form and then consists of alternate plates of ferrite and cementite. Such pearlite is shown in Fig. 5.

Cementite does not appear structurally free until a content of 0.89 percent carbon has been exceeded. Gradual increments of carbon to a structure such as Fig. 3 result in the gradual replacement of ferrite by pearlite until at 0.89 percent carbon the whole structure consists of pearlite. Further additions of carbon result in the appearance of structurally free cementite. The structure of a steel containing 1.2 percent carbon is shown in Fig. 6, it is

FIG. 7.—STEEL 0.38 PERCENT CARBON. AS CAST. MAGNIFIED 58 TIMES.

built up of pearlite (black) and thin meshes of cementite (white). The latter increase in volume with further increments of carbon until the typical pearlite cementite structure of Fig. 4 is reached. Obviously then iron carbon alloys may be divided into three classes: (a) ferrite pearlite, (b) pearlite, (c) pearlite cementite.

Practically the whole of steel castings come within the first class, that is they contain free ferrite. The structure of such a casting in the condition as cast, is shown in Fig. 7, the carbon content being 0.38 percent. The angu-

FIG. 8.—SAME STEEL AS FIG. 7 AFTER ANNEALING. MAGNIFIED 58 TIMES.

larity of the ferrite will be noted and the appearance of the structure as a whole is distinct and sharp. The same steel after annealing is shown in Fig. 8, which is chiefly characterized by the disappearance of sharpness and angularity. Chemically the two steels are

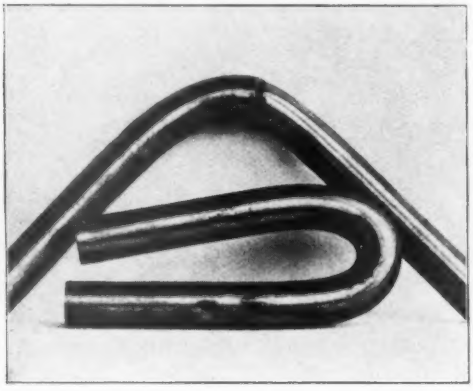


FIG. 9.

identical and they are both built up of ferrite and pearlite. The difference is one of arrangement only. Thus in Fig. 7 the demarcation between pearlite and ferrite is most pronounced and the two constituents are entirely distinct. The effect of annealing is to break down this sharp demarcation and as in Fig. 8 the two constituents are, as it were, interwoven one into the other. Apart from this interlocking, internal cohesion is also strengthened and the steel will now undergo considerably more deformation before breaking than it will in the unannealed condition. This feature is well shown in Fig. 9. The unannealed bar bent to an angle of 90° and fractured whilst the annealed one bent parallel, the two ends were brought nearly together and no apparent flaw developed. This difference in behavior is due entirely to the structural rearrangement shown in Figs. 7 and 8.

GATING MALLEABLE CASTINGS.

When invited by the editor of *The Foundry* to furnish an article under the above heading, I wondered whether a compliance with his request would, or would not be a violation of the ethics of malleable iron founding. To the gray iron man this may seem strange, and the malleable man may ridicule the suggestion, but the fact remains that as a whole the malleable men are decidedly close mouthed in matters of shop practice.

There are a few exceptions to his rule, but the exceptions are so few that numerically speaking they are not worth considering. If the reader doubts this statement, let him try to spend a day in some large malleable plant. If he is a malleable man the chances are 100 to 1 against his gaining admittance, and if by any chance he is successful in getting into the plant, he will be ushered through in the most polite manner possible by the manager, superintendent, or some other dignitary of the concern, who will be the personification of suavity and courtesy, but who will be just bright enough to keep him on the move until the tour of the plant is made. If you should be invited to step into the office on your way out, you will be charmed with the hospitality *in the office,* a good cigar, interesting conversation (on generalities, but not a word of importance on shop practice) and an invitation to come again, and you go from the plant fully impressed with the belief that they are very fine people, but when you try to remember some little shop wrinkle you have seen, you find you have learned absolutely nothing.

The grey iron man may sneer at this "Chinese wall" built around the malleable

shops, but he should remember that it isn't so many years since his confreres (with the exception of the very few who wrote foundry articles for the mechanical papers) were built upon the same lines. In fact the now prevalent and decidedly beneficial interchange of ideas as exemplified by the various foundrymen's associations dates back only to 1889, when the pioneer organization of this class came into existence.

This would seem to infer that the malleable man is not as well informed in matters of shop practice as his gray iron brother. We would greatly dislike to admit the absolute truth of such a statement, but we must admit that a free discussion and interchange of ideas among malleable men would do much toward improving and perfecting shop practice.

Do not imagine that the progress in malleable founding has not kept pace with that in gray iron. I believe we have mastered as many difficult problems in our line as the gray iron men have. The increased production per capita, the wide diversity of castings made, the lessening of cost by improved equipment, and the decided improvement in the quality of the product will compare favorably with results obtained in gray iron practice. Not many years ago the use of malleable iron was confined to the very lightest class of castings, and to the coarse, rough castings used principally in car work, but to-day we are making all classes of work in light castings, railroad work, agricultural work, and many of the foundries are turning out the finest of castings on engine and tool work in the smaller parts, for we have yet to learn how to make very large, or very heavy castings in malleable, though I know of at least one shop in which excellent castings are made up to 2,500 lbs. in weight.

A generation ago when charcoal iron was used exclusively in malleable castings, when air furnaces were practically unknown in malleable practice, and excellent results were obtained from cupola iron, the question of gating was not of so great importance as to-day. Perhaps the classes of work were not so diversified as at present, the "chill" was relied upon to obtain results that are now obtained by "feeding," and the perfection in product was not demanded, certain it is, that with the advent of coke irons, and the air furnace, together with the demand for castings of malleable properties sound, strong, and capable of high finish, the question of gating at once assumed a very important place in the mind of the foundryman, and to-day probably is the most serious, and often times exasperating problem he has to face, except possibly the making of iron of the desired quality.

In our air furnace practice we avoid many of the troubles ever present in cupola practice. Our iron is so thoroughly mixed and melted, our skimming so well done, that the bane of the gray iron man—dirty iron—is practically unknown to us, but we have our troubles in the shape of shrinkage, and cracking of castings, and to overcome these evils is the constant study of the malleable man. In many instances "chills" are used to overcome these difficulties, but on the better classes of work, the aim of the foundryman is to gate his work in such a manner as to entirely feed all shrinkages, and to so distribute the iron in the mold as to keep hot the light sections of the casting to prevent cracking.

In the matter of shrinkage, a sufficiently heavy feeder properly placed will invariably secure a solid casting, but as the ratio of castings produced to the amount of iron melted must reach a reasonable figure, it can readily be seen that any saving effected in the amount of feeder used without impairing the solidity of the casting is an important factor, especially when the greater part of the work on any particular furnace is of such a class, thence it is the study of the foundryman to secure a solid casting with the least possible waste of iron in feeders. In dealing with an iron in which the percentages of graphitic carbon and of silicon are very low, and in which the percentage of combined carbon is high we look for a great shrinkage as well as contraction, and in castings made from such irons we find a marked disposition to crack in light sections, and a decided unsoundness in the heavy sections. In castings having very light sections, or castings of unequal proportions, the lighter parts pass from the liquid into the solid state very rapidly, while the heavier parts are still in a condition between the liquid and the solid, the contraction is unequal, and as the forces of contraction as well as expansion are practically irresistible, the result is the yielding of the weaker part of the casting, which in this condition may be the lighter section, which at this time is comparatively hard, or it may be the heavier section which may be in a pasty condition, or

a condition between the liquid and the hard.

In the first instance the result will be a crack through the light section; in the second a "check," or partial tearing away at or near the junction of the heavy and light portions. The common remedy for this trouble is the placing of chills on the heavier sections to expedite the process of cooling, with the expectation of having both sections cooled and passed through the process of contraction at the same time.

Another, and perhaps better remedy, is the practice of gating the casting in the lighter sections, thus sending the iron into the heavier sections partly chilled and cooled by contact with the mold in reaching its destination, and keeping the mold hot in the lighter sections. This heating of the mold by the flow of the iron, slight as it may be, aids greatly in prolonging the time required to pass from the fluid to the hard state, especially as this iron reaches these portions of the mold, hot and in good condition, direct from the gates, while the iron in the heavier sections has been subjected to the chilling or cooling effect of passing through the damp cold mold and is already contracting.

While it may seem unreasonable to expect to hasten in one section of a casting and prolong in another section of the same casting to any appreciable extent the time or duration of the process of contraction, it is surprising to note the results obtained in this direction when good judgment based on experience is used in the attempt. In the use of chills for the purpose of preventing shrinkages, it should be remembered that the chill is not a remedy, it is simply an alleviation, for the effect of a chill is invariably to drive the shrinkage to some other point in the casting. In gating castings to overcome shrinkages it has been the writer's experience that the most successful plan is to feed the heavier parts through the lighter parts at a point as close as possible to the heavier part. This rule is not an infallible one, in fact I have seen many instances in which this plan failed to secure the desired result, but I believe these cases to be comparatively few, and in the great majority of cases I have found this a safe rule to follow. A decided advantage gained by this method is the use of a much smaller feeder than would be used in feeding directly into the heavier part. In many cases, notably small blank gears and castings of similar nature, I have found that a "horn" gate placed at the lowest point of the casting does effectual service in preventing shrinkage, as well as securing a clean casting, but on larger castings of the same class I have found the "horn" gate an absolute failure in preventing shrinkage.

I believe the most successful method of gating blank gears in sizes from 4 in. diameter and 3 in. face up to the largest sizes, is to cut sufficient feeder on the periphery and gate into the feeder, running all the iron into the casting through the feeder. This method necessitates careful gating into the feeder to insure a clean, sound casting. It also insures having the hottest iron in the feeder, which is a very important feature, as the great aim in feeding is to have fluid iron in the feeder until the casting has passed through the "pasty" stage and has reached a degree of hardness which ends the shrinking process.

We rarely use a feeder directly on top of a casting. Our experience satisfies us that in all cases where it is possible to do so, it is best to cut a feeder on the side of the casting and furnish hot iron to the feeder by gating directly into it.

In using the method of gating, care must be taken to gate into the feeder in such a manner as to catch the dirt and impurities of the iron before they reach the feeder, for if the least particle of dirty iron reaches the feeder it will be impossible to prevent it from getting into the casting. It should be fully understood that in this method of gating the "choking" of the iron or regulating its flow into the mold is all done before it reaches the feeder.

We have said that in air furnace iron we avoid the dirty iron so common in cupola practice. To be more explicit we should have said the melting process and the skimming of the iron in the air furnace eliminates to a great extent the dirt and impurities from the iron, but not wholly, therefore, in making castings that are to be finished care must be taken to choke the gate and force the impurities to the top before the iron reaches the feeder. Another essential to clean castings is hot iron. We melt our iron very hot, and on finished work pour it as hot as it can be melted. We believe that by so doing it is much easier to feed the shrinkage, and secure clean, sound castings. We have experimented considerably with thin gates, and have in-

variably found them useless in feeding the casting, in fact we find that when used on a casting of a heavier section than the gate itself, that the gate draws from, or feeds itself from the casting. Much might be written on this subject, I have simply attempted to generalize in such a manner as to encourage others to relate their views or experiences, in order that we may all learn from the experience of others.

JEAN P. FERMAL.

COST KEEPING FOR THE FOUNDRY.*

BY R. W. MCDOWELL, UNIONTOWN, PA.

In presenting a paper of this kind, it would be useless to describe a system of cost finding for any special line of foundry business, as such a paper would be of interest to only those whose foundries are devoted to that particular class of work. Therefore it will be attempted to outline a system of a general nature only, showing the main features of foundry cost accounting in as a plain and simple a manner as possible. The subject of foundry cost keeping has become of far greater interest to foundrymen than it formerly was, owing partly to the vast improvements that have been made in foundry methods and appliances, making it necessary to keep the methods in the office up to the standard of those in the foundry, but due to a greater extent to the keen competition of recent years which has made it necessary for the foundryman to know just what his product is costing, and how to reduce this cost if possible. And the only way that he can obtain this information is through an accurate and reliable system of cost records, the rough estimates that served the purpose in former years being practically worthless.

A cost keeping system for a foundry is neither as difficult to handle nor as complicated as might be imagined. Like the cost accounting for any other line of manufacturing business, it is based on four main elements of expense, namely: Material, labor, factory expense, including such items as lubricating oil, maintenance of machinery, flasks, etc., and general expense, including taxes, insurance, etc. The system should be gotten up with a view to obtaining these items with accuracy and with little trouble.

The cost system should be arranged to run in harmony with the general accounting system, being in fact a part of it. Special columns should be provided in the books of original entry to take care of the various items mentioned above, from which they may be obtained for the cost sheet. It is better to figure costs by the month, and not to attempt daily costs as it is manifestly impossible to obtain the various items of expense, outside of material and labor, daily. These may, however, be obtained monthly direct from the general account books.

Form 3

DAILY MATERIAL REPORT

Date _____ _____ No. _____

Kind of Material	Quantity	Check
No. lbs. Molding Sand		
No. lbs. Core Sand		
No. lbs. Facing		
No. lbs. Flour		
No. lbs. Chaplets		
No. lbs. Fire Clay		
No. Gals. Linseed Oil		
No. Gals. Core Compound		
No. Gals. Molasses		
No. Quarts Carbon Oil		
Sundries		

Foreman

The Foundry

In operating a cost system, one can do no better than to follow the rule given below, which appeared in an article on manufacturing accounts by Kenneth Falconer. It is as follows:

"The keystone of factory accounting is a rigid adherence to the rule that no work shall be put in hand, expenditure incurred, or goods or material delivered, without written authority emanating from the office, and that all papers and records referring to or reporting such work must bear the number of the order authorizing the same." This may be adapted to any line of cost accounting.

MATERIAL.

Iron being the most important item of the material used, the reporting of it will first be considered. Each day's heat is reported on a blank similar to form 1. This report may, if so desired, be arranged to show the amount of each charge by arranging a column for each kind of iron and leaving a line for each charge. These reports should be made up with care and measures should be taken to see that they are accurate at all times. A monthly report, Form 2, is made up from the daily reports, showing the total quantity of iron used dur-

*Paper read at A. F. A. Convention, New York City, June, '05.

DAILY CUPOLA REPORT.

Date Feb. 15. 1904 No. 38

Kind of Iron	Pile No.	No. lbs.	Per C.	Ck.
Pig. No. 1	24	10980	17	
Pig. No. 2	31	21110	32½	
Pig. No.				
New Scrap Grade A	7	18191	28	
New Scrap Grade				
Machine Scrap	11	4215	06½	
Shop Scrap		819	01¼	
Bad Castings, Heat of 2/13/05		2060	03½	
		57378	88½	
Remelt, Heat of		7622	11¼	
Total Iron to Cupola		65000	100	

Coke 8130
Flux 560
Blast on 12:50 Off 4:50 Time of Heat 4 hours
No. lbs. iron melted per 100 lbs. coke 799

Good Castings	51680	Total Iron Melted	65000
Bad Castings	1947	Deduct Result of Heat	61739
Remelt	8112	Melting Loss	3261
Total	61739	Per cent	.05

Remarks:

Form 1

The Foundry

ing the month, together with the cost. Coke and flux are also included in this report.

Sand and similar materials are reported daily on a slip like Form 3. A method of checking these slips should be provided so as to insure accuracy. Molding and core sand should be brought in on trucks of large capacity, each truck load being weighed as it passes over the scales. Other materials which are of convenient bulk for keeping in the store room are obtained by means of requisitions. The ideal method of keeping track of material would be to keep it all in the store room and let nothing go out without a requisition having been made out for it, but in the case of iron, coke, sand, etc., this would be impossible, so that the only method to pursue is to correctly report them.

Stock records should be kept, and whenever any material runs low an inventory of it should be taken and the stock record checked with it. Besides proving the records, this saves a great deal of time at the close of the year, as it will not be necessary to take a full inventory of all materials. A convenient form of stock record is shown in Form 4.

LABOR.

The next expense item is the labor. There are a number of methods of keeping track of the labor in a foundry, all of which have their

Form 2

IRON REPORT FOR MONTH OF _____ 190____

Kind and Grade of Iron	Weight	Total	Perct.	Price	Amount
Pig No. 1	274560		16½		
Pig No. 2	532180		31¾		
Pig No.					
Scrap, Grade a	319468		19¼		
Scrap, Grade B	163194		09¾		
Machine Scrap	112139		07		
Total New Iron		1401541	83¾		
Shop Scrap	196633		01¼		
Bad Castings	52894	72557	03½		
Total		1474098	87½		
Add Remelt		196842	12½		
Total Iron to Cupola		1670940	100		
Cost of Iron					
Coke	208870				
Flux	11910				
Total					
Good Castings	1258960				
Bad Castings Deduct	51614				
Remelt	197346				
Whole Results	1507920	1507920			
Loss		163020	09¾		
Net Cost of Iron					
Cost of Coke, Flux, etc.					
Whole Cost					

The Foundry

own advantages, and it depends largely on what proportion of the labor is paid for by the day, and what by the piece, as to what method should be employed. But in the opinion of the writer, the best method is found in the use of one of the modern time recorders. The time of each man is thus kept on a card similar to Form 5 for any desired period. The illustration shows a card gotten up for bi-monthly pays. The time of molders working on piece work is taken from the production sheet, Form 6. The exact arrangement of this sheet will depend largely on the classification of the product, but the form shown gives a good idea of about what will be required. It may be made up from cards turned in by the molders, or a report may be made up daily by the timekeeper or factory clerk, going from floor to floor and taking down the name, number, pattern and number up, of each molder. This is entered on the production sheet, and the sheet made up in as many copies as required. It is

Form 4

RECORD OF MATERIAL No.

Name of Material Where kept.

Received				Used				Balance	
Date	Order	Amount	Total	Date	Order or Req.	Amount	Total	Date	Amount

The Foundry

Form 6

PRODUCTION SHEET FOR _____ 190 _____

Names	Nos.	Name of Casting	Pattern	Order	No. Up	Bad	Good	Wt. Up	Wt. Bad	Wt. Good	Ck.	Pct.	Classification

The Foundry

Form 7

PAY-ROLL FOR HALF MONTH ENDING _____ 190 _____

Department _____

Names of Employes	Nos.	Sat 1	Sun 2	Mon 3	Tue 4	Wed 5	Thu 6	Fri 7	Sat 8	Sun 9	Mon 10	Tue 11	Wed 12	Thu 13	Fri 14	Sat 15	Hours	Pcs.	Rate	Day Work	Pc. Work	Pro.	Non Pro.	Total	Deduct.	Amount Due.

The Foundry

Form 8

PURCHASES FOR MONTH OF _____ 190 _____

	Supplies	Iron	Equipment	Labor	General Expense	Patterns	Factory Accounts			General	Fol.	Names	Fol.	Accounts Payable
							Expense	Repair	General					

The Foundry

completed when the weighmaster's copy comes in to the office giving the result of the heat.

The time book or pay roll is shown in Form 7. This is arranged in very much the usual manner, with the exception of the provision which is made for separating productive and non-productive labor, for convenience in figuring costs. When the plant is arranged by departments, one or more pages of this book may be allowed for each department.

FACTORY AND GENERAL EXPENSE.

Special columns for recording factory and general expense should be run in the journal, cash book, and purchase book or voucher record, of the regular account books. In this way all expenses incurred during the month are classified in the regular books and are in the most convenient form for posting to either the main ledgers or the cost sheet, and it is thus assured that no expense items will be omitted in making up the cost sheet. A shop order is issued monthly for keeping track of all repairs, all material and labor used for this purpose being charged up against this order. A page of the purchase book is shown in Form 8, showing the arrangement of the special columns. In case of the plant being divided into departments, columns are allowed for each department, also.

THE COST SHEET.

The cost sheet is shown in Form 9. Material, other than iron is obtained from the "used" division of the stock records and figured at cost value. The cost of iron is transferred from the monthly iron report. Productive and non-productive labor are then obtained from the pay roll, and then come factory expense, general expense, fuel and light and sundry expense, taken from the special columns in the regular books, and repairs as shown by the shop order. The total of these items gives the net cost of production. To this total is added freight, office expense, patterns and special expense, giving the whole cost of operating for the month. It is customary with some foundries to charge up the expense of producing patterns against the cost of the regular product, but the belief of the writer is that they should be treated in the same manner as machinery or any other equipment for the reason that they are not an actual factor in the cost of getting out the product any more than the cupola is. One would hardly charge up the cost of the cupola against the cost of the first month's production, and it is scarcely more reasonable to charge up expensive patterns against the cost of production of the month in which they were made, when these same patterns will be used for many other months to come, in a great many cases, and if such items are included, a false

Form 5

ORDER NO. _____

DATE _____

EMPLOYEE NO. _____

ARTICLE _____

_____

OPERATION _____

DATE		IN	OUT	IN	OUT	TOTAL
1-16						
2-17						
3-18						
4-19						
5-20						
6-21						
7-22						
8-23						
9-24						
10-25						
11-26						
12-27						
13-28						
14-29						
15-30						
31						

TOTAL HOURS _____ MIN. _____

RATE _____

AMOUNT _____

San Francisco Office.

The Foundry

cost per lb. of the finished product is the result. Therefore a distinction should be made between the cost of production and the cost of operating for a given time, and patterns

Form 9

Cost Sheet for month of _____ 190__

Expense Items	Cost	Extension	Total	Last Mo.	Differ.
Iron					
Coke					
Flux					
Molding Sand					
Core Sand					
Linseed Oil					
Other Material					
Sundries					
Total Material					
Productive Labor					
Non-productive Labor					
Repairs					
Factory Expense					
General Expense					
Fuel and Light					
Foremans Wages					
Net Cost Production					
Patterns					
Office Expense					
Freight					
Special					
Total Cost of operating					
Good Castings					
Machine Work					
Sundry Jobs					
Total					
Deduct Cost					
Profit					

The Foundry

should be included in the latter division, but not in the first.

If so desired, the sheet may be arranged according to departments, and this arrangement is desirable in a large plant, but it is not so shown in the illustration, as this is intended to illustrate a general system.

The forms shown here are intended to represent and illustrate the simplest possible forms and methods of foundry cost accounting, and would, of course, have to be modified considerably for the requirements of any special line of foundry work. In this form, however, they are more easily adapted to the needs of anyone wishing to design and operate a cost system on these lines, and it is hoped that the system as a whole or in part may be of some benefit to those desiring to install such a system.

BOOK REVIEWS.

Jahrbuch fuer das Eisenhuettenwesen, Vol. III.—The Iron and Steel Institute, of Germany, annually publishes a substantial volume of reviews and references embracing the entire literature of the iron industry. The present volume is an improvement on those already issued, and gives evidence of the thoroughness and care taken to make the work a reliable book of reference for the year 1902. The Journals from which the articles were tabulated number 134, most of them being in languages other than the German. The volume is cordially commended to those who desire to become posted on the literature of the specialty they are studying, and can read German.

First we note the history of iron in general, its present state in the various countries that are producers, the statistics, etc.

Next come fuels, among which we note charcoal, peat, oil, gas and the coals. The gas fuels are subdivided into natural gas, producer gas, peat gas, oil gas, water gas, blast furnace gases, and special information on producers for gas from anthracite, bituminous coal, and wood.

Among the chapters on furnaces, we see that special attention is given the literature on the use of powdered coal, a subject which is attracting some attention here in connection with annealing. Refractories, slags, ores, works arrangement and the production of pig iron continues the arrangement of matter, and then we come to foundry practice. Nothing more than a bare mention of titles is given here, but these fill 14 pages, and the majority come from the columns of *The Foundry*. When it is remembered that this is only for 1902, it shows what activity prevails in what may be called the "intelligence department" of the foundry industry.

Wrought iron, steel, steel castings, finished products, the properties and alloys of iron, and the analysis and testing of the materials made complete the substantial volume of over 450 pages.

The only criticism that can be made in connection with the undertaking is that the results are published too late. True, it is stated that the author was sick, and hence the publication was delayed, but the volume for 1903 is promised for the end of this year. It seems, however, that with a comprehensive card system the titles could be arranged as fast as the periodicals are reviewed, most of the items being a simple statement of the titles anyhow. The publication could then follow a few months at most after the close of the year.

The Worcester Steel Foundry Co. has been incorporated in Massachusetts with a capital of $300,000, to deal in products from iron, steel, etc. The directors are: President, J. C. Emanuel Trotz, 20 Green Lane; treasurer, William H. Cook, 67 Union street, and clerk, Edgar Whidden, of the same address, all of Worcester, Mass.

The Ross Tacony Crucible Co., of Tacony, Philadelphia, Pa., has erected a very handsome office building and just moved into it. Although this firm doubled its manufacturing capacity a year ago, its increasing business made it necessary to turn over its old office space for manufacturing purposes.

HOW PETE CADY BUCKED THE TRUST.

BY HARRY MALONE.

On a moonlight evening in October in the Palouse country a group of men were sitting around the mess tent of a theshing outfit, or as it is known in the West, a separator outfit. It was one of the big old-fashioned crews of two separators, a lot of 14-foot headers, and wagons for hauling the tops of the wheat to the separators after they had been cut off by the header. It was the end of the next to the last day's march down to headquarters. For four and a half months the crew had been in the field following the spring and fall wheat, barley, and oat harvests up the mountains as the crops ripened at the successive levels.

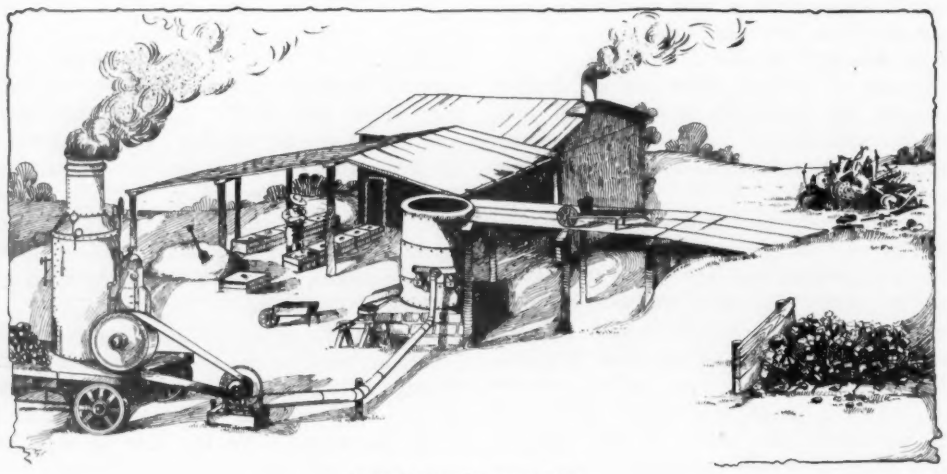
There had been no end of trouble in getting repairs for the breakages in the headers. The dealers claimed that the agricultural implement trust were so busy that they could not furnish "extras" promptly, and hence one or another of the machines of the outfits had been tied up for repairs nearly all summer long. As the boys counted up their time and realized what a serious hole this enforced idleness had made in their wages, they each and all were ready to kick at the trust.

Pete sat smoking for some time in silence, listening to the tirades of the others. Finally he said, "Is there any one of you fellows that wants to hook up with me and buck the trust? We kin just as well as not make our own extras. I learned the molder's trade down in M'zzourer, and I reckon I kin make castings yit. We kin get a good set of extras for patterns, and by working all winter ought to have extras enough to run all five of the crews that start out from this valley every year. Then we can load up a wagon with extras and go around mending machines and make good money."

Brent Higgins finally agreed to "hook up" with Pete; but unfortunately both men played a bad hand at poker; hence, counting what was coming to them they only had a little less than four hundred dollars between them, and to carry out their business scheme they would have to "grub" themselves for the winter and part of the next summer. This grub-stake alone would make a serious hole in the four hundred.

They had one asset in the shape of two cayuses.

In one way and another, however, expedients were brought forth that bridged their difficulties, and a week later when the separator crew had finished putting up the outfit for the winter, the evening's talk bore fruit. The embryo foundry company had no thought of incorporating or even of selecting a name, but set about making extras as rapidly as possible. In the first place they secured two homesteader's shacks or small 10 x 12 buildings which had been used on ranches while the settlers were "proving up." These were torn down and hauled to the side hill at the edge of the town where the owners of the separator outfit had given them permission to locate. One of these shacks was put up to serve as a bunk house for the foundrymen, and also for a flask shop and general finishing shop. It was fitted up with a home-made bench and vise on one side and a couple of bunks on the other, while a second-hand cook stove adorned the end of the room and a dry-goods box table by the side of the stove served either for stirring up a batch of soda biscuits or making cores; both the cores and the soda biscuits were baked in the oven of the cook stove.



PETE CADY'S FOUNDRY.

In making the cupola the foundrymen were certainly in good fortune, for they secured a few sections of old smoke stack from a saw mill which had been burned some years before. As no castings for bed plate and drop bottom could be obtained, the cupola was made with an extra large breast through which the refuse could be dragged out after a heat. For the first few heats the cupola was lined entirely with the yellow clay of the district. The blast was furnished by a small blower which was picked up second-hand in a mining town 50 or 60 miles away and brought over by the cayuse team with the aid of a borrowed wagon. The power for the blower was furnished by the boiler and engine of a portable wood-sawing outfit which was borrowed when not in use by the owners.

The cupola stood out in the open with a few planks forming a runway from the hill, so that the coke and scrap could be charged into the top from the bank. There was no chimney on the cupola, as it terminated on a level with the charging planks. The material from the second homesteader's shack was used to make a shed under which molding was carried on, and also to make the necessary flasks. The remainder of the outfit consisted of a couple of machinist's hammers, a few cold chisels, a few files, a couple of home-made hand ladles, and a few wood-working tools. When the plant was completed it was necessary to secure a supply of iron and coke.

The iron came easy, for all they had to do was to pull out with the borrowed wagon and the cayuses and rustle up scrap from the surrounding ranches, from the burned saw mill, and from about town. The coke was the biggest problem, and the one which

made the most expansive hole in the financial resources of the company. There was a smelter at one of the mines about 75 miles away and of course coke was always to be had at this point, and hence the cayuses had several pretty long hauls.

About the middle of November every thing was ready, even to a few loads of molding sand which had been obtained from a sand bank 25 miles away; for it must be remembered that in the Palouse country there is nothing but clay. Most of the extras required about a reaper or header weigh from two to six pounds, and few of them over 12 pounds, so that two or three days' molding would not result in a very large heat. The work at the new foundry was carried on practically all winter, as there were only three or four weeks of freezing weather, and even during the rainy season the rain was not sufficient to interfere with operations, providing the top of the cupola was kept covered when not in use. By Spring the new foundry company had a good supply of extras; and by doing some outside work in the shape of repairs on feed choppers at the ranches and the casting of some riffles for the placer mines, they had succeeded in making money enough to enable them to purchase a second-hand wagon in which to haul their extras around the country; and as the farmers gathered their harvest, the foundry company reaped its harvest also.

The boys on the separator crews were all ready to swear by Pete and his foundry, as the always-ready supply of extras kept the machines going continuously and this meant steady pay for all of the crew, to say nothing of a fatter roll for the owner of the outfit.

For the first two years the new company made lots of money and planned to secure much better equipment. The hardware dealers in one of the large adjoining towns began to wake up about this time and informed the trust, with the result that extras were laid down in that country at a price never before heard of. The trust expected by this line of action to make just about one bite of their quiet little rival, but unfortunately forgot several things entirely in their competition with the new foundry.

In the first place, the supply of scrap necessary for the modest requirements of the new industry was almost unlimited, on account of the large number of farm implements constantly being thrown on the junk heap, which in most cases, with careless Western liberality were given to "the boys" to help the cause along. In the second place, all the profits there were in the business were kept in the company, and practically the only running expense was for coke.

After one year of selling extras at cost to please the trust, the hardware dealers bolted, and demanded that the trust either still further reduce the cost to them of the extras, or else allow them to advance the price. The trust, however, had to pay for its iron and pay the freight on the finished product, and thought that it had been selling at a loss long enough, hence decided to charge the old price for extras furnished to the hardware dealers. This was equivalent to handing over the "extra" trade in toto to Pete's foundry, as by the time the hardware men had slapped on their profit the price they asked put them out of the race entirely.

Pete's foundry is a splendid example of why some foundries ought not to expand. After they had been running some time, Brent wanted to branch out and make engines and agricultural machinery. After a thorough discussion of the subject with the aid of a considerable quantity of Climax Plug, Pete boiled the matter down into a few words somewhat as follows:

"You see, Brent, if we expand we'll have to buy pig iron, for there ain't scrap enough here; then we will have to hire some other fellows to help us, and the high wages paid here will more than balance the difference between the freight on the pig iron and the new machinery; so that we can't make the stuff as cheap as them fellows back East can sell it to us. No, I tell you the "extra" business, with a few feed mills and placer riffles, and repairs now and then is what we have got to stick to, and you'll have to allow as we've made about as much as anybody in this valley, considering what we started with."

So the "extra" shop jogged on in its proper groove and left the Eastern fellows to make the machinery, which they continued to repair.

The moral of this yarn is: If you've got a good *little* thing, don't swap it for a bad big thing.

Second Annual Meeting of the British Foundrymen's Association.

The second annual convention of the British Foundrymen's Association was held at Glasgow on August 7, 8 and 9. The lecture halls of the new Technical College, George street, were placed at the service of the members—the first time they had been opened to the use of any public body—and one and all who attended the gathering were delighted with the accommodation provided.

The proceedings of the convention were inaugurated on Monday forenoon, by a meeting of the members for the transaction of business—the hearing of reports, election of office-bearers, and the president's address. There were about fifty gentlemen present, most of whom hailed from the Midlands of England.

The president (Mr. Robert Buchanan, of Birmingham) called upon the secretary (Mr. F. W. Finch, Gloucester,) to read the annual report. Since last convention the association had made steady, yet sure progress. The membership at last meeting was 83, in January last the number had increased to 100, and since than another 21 had been added to the roll, which now stood at 121. Since last convention the council had made arrangements for the production of a journal, in which would appear the papers read, and also the whole transactions of the association, and it would be duly circulated amongst the members. The secretary then added that the finances were in a satisfactory condition. He paid a high tribute to the energy of the president, who had lectured in different districts on the objects of the association, and had made arrangements for doing more valuable work of that kind. They were greatly indebted to the president and Professor Sexton for the arrangements that had been made for their present convention.

The election of office-bearers was then proceeded with.

On the motion of Mr. Varley, seconded by Mr. Bagnall (Sheffield), Mr. Buchanan was unanimously re-elected president, and on the motion of Mr. C. Morehead, Mr. Herbert Pilkington, of the Sheepbridge Coal and Iron Co., Chesterfield, was also unanimously re-elected vice president. Mr. Longmuir (London) proposed the re-election of Mr. Finch as secretary and treasurer, which proposition was likewise assented to.

The president intimated that the council at their last meeting had elected certain gentlemen as honorary members, and he asked the members to approve of the names, which were as follows: R. A. Hadfield (Sheffield), Professor Turner (Birmingham), A. H. Sexton (Glasgow and Dumbarton), and Dr. Moldenke (Pennsylvania, U. S. A.). The action of the council was approved.

The council was then re-elected as follows: Messrs. C. Morehead (Rugby), F. C. Shaw (Birmingham), Percy Longmuir (London), J. G. Stewart (Urmston), F. J. Cook (Birmingham), J. Ellis (Woolston, Hants), W. Roxburgh (Kilmarnock), Wm. Vickers (Birmingham), T. McFarlane (Horsehay, Salop), R. Mason (Birmingham), W. F. Bagnall (Sheffield), and J. Thomson (Glasgow).

The president then stated that the council had been engaged preparing rules for the association. They had been very carefully gone into, would be submitted to the members, and will come up for consideration next year, when they will fall to be adjusted as the members might see fit.

Mr. Finch, in returning thanks for re-election, pressed the members to do their best to get new accessions to the body. If every one put his shoulder to the wheel that could easily be done, and by so doing he felt convinced that their membership would be at least 200 by another year.

Mr. Smith (South Shields) questioned whether employers generally knew that such as association as theirs existed. He suggested that *every* member should let *their* employers know of *their* existence, asd ask *their* support, because whatever knowledge *they* gained through the association was of value to the employers, who, he believed, would lend their countenance and support if asked. They were going to have a very large association before long, and they should do all they could to help it along.

The president replied that they had circularized all employers, managers and foremen, but he was afraid circulars were so common that *they* had not always been looked at. He personally thought that employers ought to take a more living interest in the association, more even than managers and foremen. They were there for love of the work, and

no doubt if the employers came to realize the importance of the work done they would support them freely. He was glad to say they had employers in the membership, and in the new rules they had made provision whereby employers might have a direct interest in the association. They were there to educate themselves and one another, and the association would wholly fail of its function if it did not reflect in the work done in the foundries throughout the country better and more economical results than had been yet seen. Most certainly they should have the employers' good will, and their aid, too, if they felt so inclined.

The business meeting closed with a vote of thanks being accorded the members of the council for their past services, and an adjournment was made to a larger hall, where the president delivered his

Presidential Address.

Mr. Buchanan, having expressed the appreciation of the association of the courtesy of the governors of the Technical College in placing their rooms at the disposal of the association, and acknowledged the honor conferred upon himself, proceeded to say that he claimed that since its inception the association had proved itself worthy of the support of those who formed the membership. He thought it well to restate the fact that with the monetary relationship of employer and employed they had nothing whatever to do. They were there for the consideration of practical and scientific questions pertaining to the great industry which they in some measure represented. The usefulness of the association did not cease with their parting. During the year that had elapsed since last convention it had been the privilege of many of the members who might be experts in particular lines of work to give counsel and help to members who had trouble with castings. Sometimes these difficulties had arisen from very obscure causes, though the results which arose in the form of "waster" castings were of the most obvious character. By such help they hoped to impress upon all connected with the industry that the association existed solely for the benefit of those engaged in it. On that ground they asked the support of all in their ranks who desired the onward advance of the art of founding.

Any one who had been much in contact with foundry workmen, or indeed any class of workmen, could not but have been made aware of the prejudice which obtained that no improvement in methods of manufacture could come from any one not directly engaged in the business. Yet some of the greatest improvements and developments in mechanical and scientific procedure had come from sources and from men outside the circle of the industries benefited and advanced. Having instanced a number of what might be called "outside" developments and discoveries, Mr. Buchanan went on to observe that the most obvious lesson to be drawn from experience was that outside their own immediate environment there were many brains working at, and many hands probing, the secrets of Nature, so that as time went on there might be put into their hands better and more accurate means of production. It was well therefore to keep an open mind ready to receive improvement from whatever source it came, having learned by experience to winnow the chaff from the grain.

In the various branches of the industry with which they were connected, the casting and founding of metals, he could see no indication of any great advance unless it might be in the case of the converter of the *Tropenas* type for the production of small steel castings. Although there might be no present indications of any great advance in the casting or founding of metals, he felt it was not too much to say that were there in every foundry in these islands at least one man abreast of the scientific and metallurgical knowledge applicable to the business, that in itself would form an advance equal to anything they had seen in their own or any other industry, and that association aimed towards helping to the creation of such men. After noting an instance where ignorance had played an expensive part in the mixing of metals, the president proceeded to suggest that employers owning iron works and foundries should provide for the use of those responsible for the work the latest and best text-books which treated of matters relative to the particular business. Some far-seeing business men were doing so already, and it was an example which might be largely followed with advantage.

It was absolutely necessary for those engaged in productive work that they should keep abreast of the best methods, whether scientific or practical. He was not sure that he was right in speaking of scientific and practical work as if they were separate things.

Practical work to be of the best kind must necessarily be scientific, and science was knowledge reduced to a system. Some of them used the laboratory and the microscope as adjuncts to the foundry work, but in how many foundries would these not form "a delusion and a snare"? It was said long ago, "It is amazing with how little wisdom nations are governed." One could truthfully apply the saying to many foundries. The president subsequently condemned the practice of forcing on the men in charge of a foundry tools and molding-machines in the choice of which they had no say, and advocated that they should have supplied the particular types which they believed would produce the best results—and then they should be held to realize the promised results.

Besides he looked upon it as an obvious necessity of the foundry that the workmen should be supplied with an adequate number of tools with which to work, so that the time lost in looking for the same should be reduced to a minimum. There was a great leakage under this head, and in many foundries more time was wasted every week in this way than in value would supply each man with a new outfit of tools. Superficial observers were apt to think that the time lost fell on the men. That was a fallacy. If the men could make a wage under the narrow conditions that here and there prevailed, then under the conditions which he advocated they would make at least as much money for themselves as formerly, and the costs to the employers would be considerably reduced. There were, as he had indicated, foundries in different stages of development, and the proper first step in advance might differ in each case. In many instances the provision of tools and plant, good cranes, plenty of well-designed molding-boxes, ample blowing-power and melting-power would in themselves be a revolution in economical production. If these were wanting it was useless to expect the application of scientific principles to foundry work. It was in the work of the wealthy and successful firms where one found the highest application and development of scientific principles. They adopted the best tools that the engineer could provide, and as a next step called for the chemists, the metallurgist, and the scientist to continue the progress. It was only the unintelligent and retrograde who thought they could afford to do without these things. To such minds finality of method was a great desire, but in these bustling days there was no finality, and they would be foolish to look for it. "The old order changeth, giving place to the new," said Tennyson. So must they adapt themselves to the changing times. That attitude of mind was not an affectation nor a fashion; it was a necessity of existence.

Technical Education and the Foundry.

Professor Sexton, F. I. C., F. C. S., Glasgow, followed with a paper on "Technical Education and the Foundry." Before proceeding with his subject proper the professor mentioned that the Technical College buildings in which they were assembled were erected on the site of the old Andersonian College, founded in 1796 by Professor John Anderson as a workman's university. Going on, he then observed that the extent to which technical education could be given and the conditions under which it could be given depended upon the nature of the industry and on the opportunities of the students. Engineers frequently spent three or four years in the day classes of a college, before, after, or concurrently with their practical training in works, whilst in many other cases, as generally with foundrymen, the only technical education possible was that which could be obtained in evening classes. Foundry work was still in many ways behind some of the other branches of engineering industry. The reasons were several: (1) The neglect of technical training, (2) the small scale on which the work was carried on in many establishments, and (3) the secrecy which had been maintained as to methods, so that each man had had to work out his plans independently, which always led to waste of time and energy, and prevented industrial development. Their association was likely to do a good deal towards overcoming that difficulty, and if it had any success in that direction it would do much for the work of the foundry. Supposing that a foundryman was anxious, he put it, to acquire technical knowledge, what would he need to learn? The subjects to be acquired he tabulated as—(*a*) a good working knowledge of arithmetic, algebra as far as the solution of single equations, elementary geometry, and the use of graphic methods of calculation, the last named including the use of squared paper (of the utmost importance). (*b*) A little skill in drawing would be of the greatest advantage, so as to be able to understand the plan and elevation of an ordinary mechanical drawing.

(*c*) The elements of chemistry so far as to be able to understand chemical facts, the necessary chemical language, and the use of formulæ and equations. (*d*) A knowledge of the phenomena of heat, as far at least as the phenomena of expansion and solidification and latent and specific heats were concerned. It was the acquisition of that preliminary knowledge that presented the greatest difficulty; and yet if the subsequent work were to be properly understood the labor must be undertaken, and no young man or older man who faced it would regret the task. Then the technical study would include a study of the metallurgy of iron, at least so far as the methods by which pig iron is manufactured, to know how far the quality of the metal is under the control of the manufacturer, and how far this may be modified by the processes of manufacture. The study of foundry work proper included a vast range of subjects, such as the influence of the various constituents of pig iron, fuel for the cupola, cupola designs, blowing, molding-sands, the principles of the various operations, and the principles on which the various machines used in the foundry were based. It was not absolutely necessary to attend classes to attain this requisite knowledge, but it was best to do so, if at all possible. Such a course as laid down would take about four sessions, attendance being given two evenings a week—two sessions being devoted to the preliminary subjects and two to the technical; and the former should be mastered before the latter were taken up. The advantages to follow were many, but the chief was that those who learned intelligently would understand the problems of the foundry, many of which were still waiting for solution. The development of an industry did not depend on the teachers, or the men of science, but on the trained minds engaged in it, who could see the problems and could understand how they should be approached. The future of the industry rested with the trained workers.

In a conversation which followed, the president testified to the value of evening classes, but added that the work should be undertaken for the love of acquiring knowledge and not for ulterior motives, which in themselves were not wrong but might lead to disappointment when made the main object of study.

CAST IRON.

Mr. Herbert Pilkington, F. I. C., F. C. S., the vice president, next read a paper on "Cast Iron." At the outset he remarked that the selection of pig iron, its mixing and melting, and subsequent treatment in the foundry, must always be a subject of profound interest to every foundryman, and yet it was doubtful if this branch of foundry practice in this country had received that consideration which its importance demanded. During the last few years there had been an awakening of foundrymen to the scientific considerations which bore upon foundry practice generally, and the formation of that association was concrete evidence of the fact. There were many foundries where every care and consideration was given to the subjects, where chemical analysis and mechanical tests controlled the whole system. On the other hand there were many more where these points received little or no attention, and there were others which kept chemists and yet had no one in authority capable of adequately using such advice as was forthcoming. But the influence of scientific methods was asserting itself and it seemed as if they were entering upon a period of enlightened inquiry on the part of the foundryman, and in the part to be played that association promised to take an honorable share. Mr. Pilkington then in some detail went on to describe the varied composition and complex physical construction of cast iron, incidentally noting that probably two of the best foundry irons in this country to-day were Scotch and Derbyshire. Touching upon the question of remelting he observed that cupolas were bad mixers and he strongly advised the use of large foundry ladles or receivers in such an operation. Having dealt with the nature of some of the constituents of cast iron, the reader proceeded to discuss the question of grading by analysis, which was attracting considerable attention in these days. He mentioned that it was noticeable that casting-machines for foundry pig iron in this country have made no headway, the pigs where mechanical handling had been introduced being lifted by cranes and broken by machines. This was done to preserve the fracture, as buyers generally would not take the iron from casting-machines, owing to the broken or scattered fracture. This might be prejudice, but he was of opinion that silicon was of itself an unsafe guide to grading the character of pig iron, without the assistance of fracture. High silicon, he added, might be found occasionally in forge pig iron; high sulphur might be found with it at times. The

fact was that the fracture showed that the carbon was either in a normal or an abnormal condition, and that was of value in itself. If a very gray iron at the furnace was run into pigs very slowly its fracture when cold was a very wild and scattered one, and it would in all probability be graded No. 4 foundry; by analysis it would be graded as No. 1 or No. 2. In all probability pig iron would meanwhile for foundry purposes continue to be bought by both fracture and analysis, and that until more experience as to its mysteries has been obtained. Mr. Pilkington next dealt with microscopical analysis of cast iron, and explained the same by means of diagrams. In conclusion, he said that it might be asserted that questions of temperature both in melting, casting, and cooling in the foundry were obviously of paramount importance, and with the improvements in pyrometry which had taken and which were taking place they might confidently look forward to the acquisition of knowledge of much greater precision on these heads than was now possessed.

A brisk discussion followed the vice president's paper.

Mr. Smith (Sheffield) asked if Mr. Pilkington thought that the quality of the pig iron made nowadays was equal to what was produced a few years ago. It sometimes occurred to him that pig iron was not now of the quality they got 20 to 25 years ago, and he believed that that was the cause of many troubles met with in melting.

Mr. Pilkington thought there was probably some ground for Mr. Smith's suggestion. At the same time he felt that Middlesbrough iron was as good to-day as it was years ago; and he was inclined to add that all specific brands of pig iron were as good to-day as they were years ago.

Professor Sexton said he had made a great many analyses to learn the constituents of pig iron, and in regard to some brands he could say that, compared with 25 years ago, they were not the same irons at all. In that district, with the exception of two works, the whole of the material now used in the manufacture of pig iron was imported, and they could not expect the iron to be the same. But every effort was made to keep the irons up to the old standard, and the irons that were made to-day were just as good as ever they were; but there were greater variations in quality than used to be the case.

The president drew attention to the kinds of hematites which were sent in to foundrymen at times, and said he was satisfied that they often got what had been refused at the steel works. As to the strength of iron not being what used to be the case, he believed that iron could be made as strong as ever when they knew how to do it. Anyone working with the knowledge acquired could make iron equal to anything that ever had been made; but they must mix their brains with the iron.

Votes of thanks were accorded Professor Sexton and Mr. Pilkington for their papers, and the convention adjourned.

The afternoon was spent by the members in a visit to the Carron Iron Works, Falkirk.

The Second Day's Proceedings.

The convention resumed on Tuesday morning at 9:30, and the forenoon was devoted to the reading of papers. Mr. Buchanan presided and there was a good attendance.

MOLDING-SANDS AND FIRECLAYS.

Mr. Percy Longmuir (London), metallurgist and Carnegie medallist, read the first paper, on "Molding-sands and Fireclays." The author first treated of the approximate temperatures found in foundry furnaces and of mold-temperatures (showing the variations by blackboard diagrams), and remarked on the high resistance to heat which was therefore rendered essential in lining. In noticing the compositions of which linings were formed, he mentioned that the nearest approach to purity in samples commercially used was that of Belgium white sand, which was very infusible and was used for forming the bed of the open-hearth furnace. This sand possessed no "bond"—that was, it could not be rammed into a given shape; neither could it be manufactured into brick without admixture. On the other hand, ganister—an essentially silicious material—contained sufficient clayey matter to permit of the ground material being molded into any required form. Then, to a limited extent, various silicious rocks were used in furnace construction, and also a large class of materials comprised under the general term basic, but the latter did not meet with very extensive adoption in foundry practice. Although basic linings resisted very high temperatures, they were not so easy to manipulate as acid linings. Consequently basic lining was only used when the slags of the process were of such a character that they cut into or united with an acid lining. In considering the action of a basic slag on

an acid lining it was equally obvious that similar conditions held good when acid and basic refractory materials were heated in contact. This remark introduced another class of refractory materials, termed neutral, in that they were unaffected by either basic or acid materials. Therefore a neutral material acted as an isolating material between the acid and basic portions of a furnace. Such a material was found in chromite, an extremely refractory substance. The most interesting members of the neutral group of refractories were found in fireclays, the properties of several of which Mr. Longmuir defined in some detail. Turning from furnace materials to molding-sands certain points of similarity were noted, in that both must resist high temperatures; further, that molding-sands being acid it followed that silica was a predominant constituent. He thought his audience would agree with him that the requirements of a sand were greater than those of furnace linings. The latter had to resist heat, furnace atmospheres, but in certain cases a molding-sand must resist not only temperature but also the penetrating action of a thinly fluid metal or alloy. Of necessity this latter property must be associated with porosity in the sand. Several analyses of molding-sands used in foundries were next submitted, and the chemical differences pointed out, and a number of "mixtures" were repeated. In closing, Mr. Longmuir said that the time had not yet arrived for establishing a definite relationship between the chemical composition of sand and its practical use. The author in conjunction with Mr. McWilliam was engaged in investigating certain variations, and they hoped eventually to contribute something towards the establishment of a correlation of chemical composition and working properties.

A brief discussion followed.

THE MICROSCOPE AND PIG IRON.

Mr. A. Campion, F. I. C., F. C. S., Carnegie Gold Medallist, Technical College, Glasgow, followed with a paper on "The Miscroscope and Pig Iron." It was mainly an illustrated address, the results of microscopic treatment of sections of pig iron being shown by means of lantern slides on a screen. The features brought out proved of great interest to all present.

PROFITABLE FOUNDING.

Mr. John G. Stewart (Urmston) then dealt with "Profitable Founding." Preliminarily, the author expressed the hope that ere long the committee of management of the association would issue notices to the effect that qualified members had undertaken to investigate respecting matters of importance to foundrymen, including the much-neglected part of commercial management—dealing with cost accounts and the simplest and most reliable methods of handling foundry accounts in general. It should be the aim of proprietors and managers so to run the plant over which they have control that the year's working would result in the presentation of balance sheets affording pleasant and profitable reading, and acceptable to all parties interested. To accomplish this demanded hard work, deep thinking, and careful planning on the part of those responsible. To meet foreign competition, the demand of engineers, the present-day keenness amongst buyers, and the ever-increasing call for castings of maximum quality at a minimum cost, it was expedient that they should study well their foundry, paying as much or more attention to it than to the machine and fitting shops, for while the latter showed the material in the finished stage of production, it was from the foundry that the foundation of a fine specimen of mechanism emanated. The present was the day of the specialists, and therefore to keep ahead they should specialize. The success of a business depended upon definite and comprehensive knowledge of every important detail of such business, and therefore the management should be always in possession of sufficient knowledge to discuss modifications with the heads of departments, and for that they should have in all concerns the best assistance—practical, commercial, and technical, procurable. The key to financial success lay in realizing the cost section. There were many firms who never asked whether they were paying too much for this or that, and who never sought to secure the same terms as the firm down the street; they were content if they had a profit. The purchasing of material in the right markets and at the right time, the watching of market reports, business ability in the management, co-operation of the officials, foremen, and workmen, all tended to success. Having elaborated these points at some length, Mr. Stewart summed up by stipulating as a necessity to success that each well-equipped works should have (1) a purchasing department, which should look after the securing of raw material, fuel, etc.; (2) management—a suitable manager and heads of departments; (3)

a controlling system dealing with the intake and output of the business, affording a means of keeping definite track of each job; and (4) advertising. Some might say that founding was hardly a business capable of extension by means of advertising. He simply mentioned the matter, but he hoped to have an opportunity of dealing fully with that question in another paper. In the meantime he affirmed that foundry businesses which, owing to a lack of enterprise on the part of proprietors, were at a standstill, were capable of development to a degree unattainable other than by judicious advertising.

The president then proposed a vote of thanks to the readers of the various papers. He next moved that the thanks of the convention should be given to the governors of the Technical College for the facilities they had afforded them, and to Professor Sexton and his assistants for the trouble they had taken in their behalf.

The afternoon was spent in visiting the works of the Steel Co. of Scotland at Newton and the Glenfield Works, Kilmarnock. Wednesday was devoted to sight-seeing in the West. In the laboratory of the college a number of micro-sections of metals were laid out, and these were described to the visitors by some of the assistants. There were also shown a number of photomicrographs illustrating the structure of various metals, lent by Mr. A. H. Hiorns, principal of the metallurgical department, Birmingham Municipal Technical School.

ASSOCIATIONS AND SOCIETIES.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The New England Foundrymen's Association, after successful outings during the summer months, resumed their monthly meetings on Wednesday, Sept. 13, at the Exchange Club, Boston. Dinner was served at 6 o'clock, after which the routine business was disposed of in the usual manner, President John Magee presiding.

An application was received from the S. Obermayer Co., New York city, and on motion they were unanimously elected to membership.

Announcement was made that the association had accepted an invitation from the United Shoe Machinery Co. to inspect their plant at Beverly, Mass., on the afternoon of the next regular meeting, which will be held on Oct. 11, and the evening meeting would be held at the Exchange Club, Boston, where a prominent speaker will be present to make an address, same to be announced later.

Vice President Snow reported that the executive committee had secured some of the best and most prominent men connected with the foundry industry to address the association during the coming season, and earnestly requested that all the meetings be largely attended. The association now has a membership of over a hundred representative concerns of New England, and it is the desire of the officers to induce all foundrymen who are not affiliated to join with us. Our objects are the advancement of the interests of foundry operators, the promotion of mechanical and industrial interests, and the collection of proper information connected with the foundry business and the encouragement of harmony and uniform customs among its members.

On motion the chair appointed Messrs. Doherty, Caley and Miller a committee of three to canvass for an increased membership and attendance at the meetings.

The president then introduced as the speaker of the evening Mr. E. H. Mumford, of Philadelphia, who gave an illustrated talk on the subject: "A New Multiple Molding Process." A slight discussion followed, at the conclusion of which a unanimous vote of thanks was extended to Mr. Mumford for his very interesting remarks.

There being no further business the meeting adjourned at 8.50 p. m.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 149th meeting of the Philadelphia Foundrymen's Association was held at the Manufacturer's Club, Philadelphia, on Wednesday, Sept. 6, with about 30 members and visitors in attendance. The meeting was called to order at 8:45 p. m. by W. I. Haldeman, in the absence of the president and vice president.

The secretary presented the report of the treasurer showing a balance of $2,050.90. After due acceptance of this report the chairman called upon Mr. Jos. I. Dinkelspiel, of the Partamol Co., New York city, who read a paper on "Partamol."

During the course of his remarks Mr. Dinkelspiel explained the use of this new

substance as a perfect parting for molds of any size castings made of iron, brass, bronze, aluminum, etc., and cited cases where partamol is most economically used as a substitute for lycopodium. "Dusted lightly," it acts as a perfect separator, preventing the sand sticking to the pattern and consequently producing a sharp, clean and perfect mold. It permits the mold to absorb the water thoroughly, standing proper swabbing without the water running.

In the brief discussion which followed the reading of the paper, Mr. Dinkelspiel was asked if partamol could be used for stove work, such as nickel trimmings and edges or other parts cast out of fancy metal. He replied that he thought it could be used with a great deal of satisfaction, and that it is very much better than any parting sand to be obtained, besides being more economical. Where a man puts up a great many molds in a day, partamol pays for itself many times over, and for ornamental iron work "it cannot be beaten."

After a vote of thanks had been extended to Mr. Dinkelspiel for his presentation of the subject, the meeting adjourned for buffet lunch, which was served on the roof garden of the Manufacturers' Club.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co., West Carson Street.

The first meeting of the Pittsburg Foundrymen's Association, after the summer vacation, was held Monday evening, Sept. 11, at the regular meeting place, 410 Penn avenue, Pittsburg. Papers were read by W. S. Quigley and H. D. Harvey on "Brass and Metal Melting Furnaces," and by A. W. Slocum, on "Recommended Specifications for Cast Iron."

Newark Foundrymen's Association.

H. L. Gebhard, Secretary, 36 Francis St.

Members of the Newark Foundrymen's Association transformed "Achtel-Stetters" dining hall on Broad street into a foundry and machine shop, on Wednesday evening, Sept. 13, 1905, the occasion being the semi-annual meeting of the association.

Representatives from almost every foundry in Newark and vicinity were present and a very profitable evening was spent.

Dinner was served at 6:30 p. m., after which the blast started.

Among the topics discussed during the evening were the "Pig Iron Market," "Foundry Cost Systems" and "Trade Outlook."

The next monthly meeting will be held at the Board of Trade rooms on Oct. 4, 1905.

The newly-elected officers for the ensuing year, are as follows: Mr. D. M. Meeker, president; Mr. F. L. Eberhardt, Vice President; Mr. H. A. Hanway, Treasurer; Mr. H. L. Gebhard, secretary.

Hamilton, Ont., Foundry Foremen's Association.

A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

The Hamilton Foundry Foremen's Association held its first meeting for the fall and winter on Sept. 28. There were a number of addresses on foundry subjects and a supper. Everything looks favorable for a very good series of meetings during the coming winter.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, Secretary and Treasurer.

The Cleveland Club of Associated Foundry Foremen, together with the Cleveland Club of Associated Patternmaker Foremen, held a joint outing at Put-in-Bay, Saturday, Aug. 26. Over 230 were present, including the members of both associations, their friends and families. These outings are certainly of much value, as they serve at times to bring the men together so that they can talk over various matters at their leisure, and it is certain that many good ideas changed hands and many valuable suggestions were given upon this trip; but there is more than simply the shop side to either the foundryman or patternmaker, as the forming of acquaintances and learning the personality of others engaged in the same business, always has a tendency to more harmonious working and to better foundry practice. When one is well acquainted with a man in charge of another plant he can judge more nearly what kind of treatment he can expect at his neighbor's hands, and much of the bitterness of the keen competition, so common in these days, is cut out by such good fellowship.

On the way up a group of foremen got together on the deck and styled themselves "The Plumbago Club." Speeches were made and a general good time indulged in. At

the bay the various sights were taken in and all got dinner, some having arranged for basket picnic dinners and others depended upon the hotels.

PRESIDENT A. L. HATT ADDRESSES THE PLUMBAGO CLUB.

The day was ideal, and it was a tired but happy crowd that landed from the boat in Cleveland that evening. All voted the outing a decided success.

OFFICERS OF THE CLEVELAND PATTERNMAKERS ASSOCIATION ON THE HURRICANE DECK.

Philadelphia Foundry Foremen.

W. P. Cunningham, American Bridge Co., Secretary.

The regular monthly meeting of the Associated Foundry Foremen, of Philadelphia and vicinity, was held Sept. 7, at the Royal Arcanum Hall. Although one of the speakers was unable to be present, there was a very good meeting from a technical point of view, and the fall and winter series of meetings promise to be very successful. There was a good attendance and great interest shown by all present.

THE ASSOCIATED FOUNDRY FOREMEN.
Frank C. Everitt, Secretary, 2413 Third Avenue, New York, N. Y., care the J. L. Mott Iron Works.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
C. H. Thomas, 14 Elizabeth St., So. Norwalk, Conn., District Vice President.

ERIE FOUNDRY FOREMEN.
W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.
W. S. Keller, of Hetherington & Berner Co., District Vice President.

CINCINNATI FOUNDRY FOREMEN.
E. W. Cadwell, Secretary.

MILWAUKEE FOUNDRY FOREMEN.
Sol. Shaw, care Clinton Street Foundry of Allis-Chalmers Co., Secretary.

CHICAGO FOUNDRY FOREMEN.
Mr. Thompson, Link Belt Co., District Vice President.

A NEW TYPE OF METAL SAWING MACHINE.

The Railway Appliances Co., Chicago, Ill., has recently brought out a new design of metal sawing machine for cutting off gates from steel castings. Three of these machines have recently been furnished to the American Steel Foundries and are reported to be rendering very good service.

A brief description of the machine is as follows: They are designed somewhat on the same principle as the arbor driven saw, built by the same company. They are provided, however, with special arrangements for steel foundry work, and with the intention of providing a machine that will permit the use of any modern cold saw, with inserted high-speed steel cutters, up to its maximum limit. In order to accomplish these results, the machines have been made much heavier in their proportions than is usual, and steel castings have been substituted for gray iron castings used in earlier machines.

The machines, as shown in the illustrations, are fitted with Taylor-Newbolt blade, 33 in. in diameter and will cut off risers up to 11 in. in diameter. The saw blade has a travel of 16 in. and with the main driving shaft running at a speed of 200 revolutions per minute the saw blade has a peripheral speed of 55 ft. per minute, and a variable feed of from ¼ to 1 in. per minute. With a variable speed the peripheral speed and feed are proprtionately increased.

The front table with which the machine is furnished has a lateral movement sufficient to enable a proper adjustment after castings have been clamped. The "V" block and clamping arrangement is a feature that permits of the quickest possible arrangements for securing castings, and is extremely desirable. The machine runs very quietly and without any vibration. One of the machines, recently furnished, on which the blade runs at a peripheral speed of 70 ft. per minute is giving excellent service, cutting off risers from steel castings with 7/8 in. feed per minute.

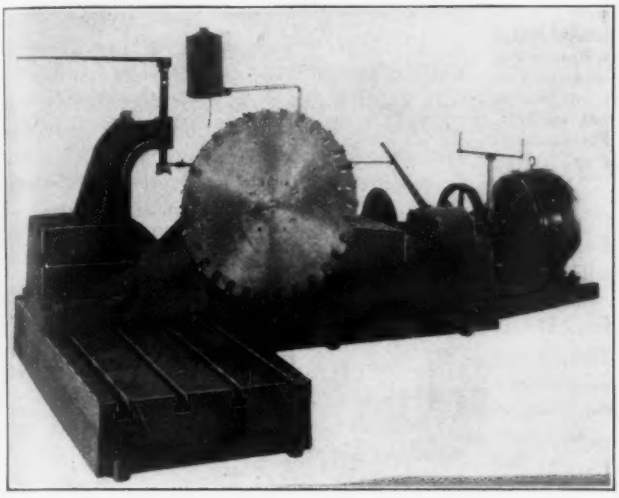


FIG. 1.—FRONT VIEW OF METAL SAWING MACHINE.

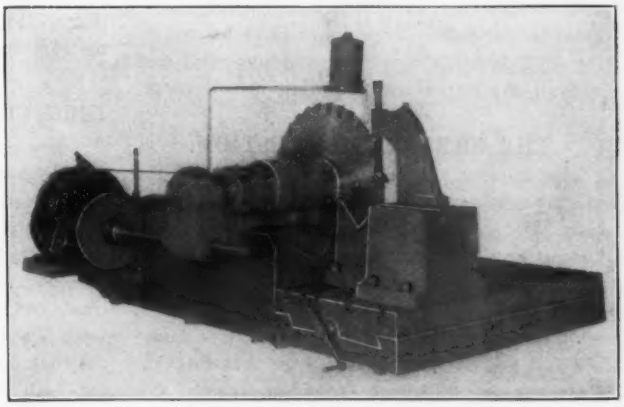


FIG. 2.—REAR VIEW OF METAL SAWING MACHINE.

TRADE PUBLICATIONS.

"Power Transmission Engineering" is the title of a catalogue issued by the Dodge Mfg. Co., Mishawaka, Ind. It is a book of 416 pages, 6 x 9 in., that is, standard size, bound in buckram. The book contains a large amount of valuable information for all interested in power transmission equipment. It not only describes the apparatus manufactured by the Dodge Mfg. Co., but also contains many tables and other useful information which would be of interest to anyone connected with this line of business. The American system of rope transmission is very fully decribed. The volume referred to is intended for desk use only. In addition to this a 4 x 6-in. pocket edition is being printed, which will be ready for distribution Oct. 1. This book should certainly be on the desk of every one in charge of large installations of power transmission machinery.

I. S. Spencer's Sons, of Guilford, Conn., have issued a remarkably well printed and illustrated catalogue, entitled "Works of I. S. Spencer's Sons, Incorporated. Illustrated by the Camera." They first state that their line is the manufacture of gray iron and brass castings, also general hardware. Then follows a statement of the location and a picture of the works in 1857 and another picture of the present works. This is followed by illustrations of the various departments, together with suitable statements concerning the same. Scattered through the book from place to place are some examples of specialties made by this company. One statement that would be of interest to their customers is that all patterns not in actual use are stored in a large fireproof vault. Another statement is that all of the work of the foundry is under the direct control of the chemist, who has charge of the chemical laboratory and physical tests.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.
J. B. Nau, Metallurgy of Steel and Steel Castings.
Dr. Richard Moldenke, Malleable Castings.
C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

MIXTURE FOR CAST IRON DIES.

Question.—Can you give me a mixture of iron suitable for making cast iron dies, such as are used by jewelers and silversmiths?

Answer.—The fine close grain that is required is not obtained by any special mixture or chemical composition. The irons charged in the cupola must have a very close grain. Stove plate scrap will probably give you the best results, and it can be softened if required by using a silvery iron, also high in phosphorus, or made harder by adding a close grained No. 4 pig iron. If not fluid enough add one percent of commercially pure aluminum in the ladle. If a figure is to be cast in the surface use a very fine molding sand and add all the fine silica sand that it will carry.

THE SHRINKAGE QUESTION.

The answer regarding the shrinkage spots in radiator castings in the September "Cast Iron Notes" was objected to as follows: "Your finding would indicate that it is entirely shrinkage because of the unevenness of the metal. Now, while the casting you have may show an unevenness we have broken quite a number and find by the closest gauge that there is absolutely no shrinkage shown, because of the peculiar shape of the cross bar or from the fact that the corners are sharp and square instead of round. Still we find just this occasional bad spot in the same place, but not always right across the mold, and there are four of these bars on the molds, and it frequently shows only at one, besides some men running day after day do not lose any castings from this bad spot. We have been making this peculiar loop for sixteen years and have never had this spongy spot before.

"We are trying to convince ourselves that the bad spot is due to some foreign matter in the iron, the coke or the sand."

Answer.—The correspondent in the first letter stated that their chemist had not been able to locate any defect in the iron. With the second letter was sent other samples, showing shrinkage spots in the heavier parts of a casting. The castings at the fracture were silvery and had no grain, but when cut with a file were extremely soft, indicating that the silicon was higher than usual in such castings, as with low silicon and so close a grain the castings should have been harder. The spots are certainly shrinkage spots, and whether caused by too high silicon or by defects in the shape of patterns. The majority of molders will be able by varying the pouring to save their castings.

The question of shrinkage is a serious one in every foundry. I have just received from another founder a casting of 1½ inch section, broken through a right angle, which shows a shrink hole very near the re-entral angle.

The analysis shows 2.20 percent silicon, and the shrinkage of a ½-inch test bar is 1.60 inch, and the grain is exactly right for moderately heavy castings.

The shrink hole occurs at the point that cooled last, because the heat could not get away rapidly at the angle. A chill placed at that point or a change of the shape of the pattern would have stopped the shrink.

IRON CUTTING THROUGH A CUPOLA BOTTOM.

An interesting case was reported recently. A superintendent was placed in charge of a shop, who was not acquainted with cupola management, but who dictated regarding it. The bottom cut through each day at the same time, and always in the same place. Experts were brought in and took the greatest care in the making of the bottom and in the charging, but with the same result.

When the melter was left alone all went right. The foundry foreman sympathized with the melter and supposed that he knew the trick and suggested that he should take off a heat and would guarantee good results. The bottom cut through at the same time as before, to his great surprise. One of the men on the scaffold guaranteed results if he was made melter, with his brother as assistant, so that one of them could be on guard all the time. The result was satisfactory.

A ten-dollar bill from the superintendent

bought the receipt for cutting through a bottom. While the attention of the men was directed away from the charging door a long bar was pushed down alongside the lining and a hole punched in the bottom and a pail of water was poured in when the bar was withdrawn.

Another case in another town the iron and slag both flowed from the taphole. This caused a constant blast through the hole, which blew the sand of the bottom out and towards the end of the heat cut a hole through the bottom. With a smaller taphole, so that the blast would not blow through there was no trouble.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

DEFECTS IN THIN CASTINGS.

Inquiry.—Our company is manufacturing light yellow brass castings, in which the metal is very thin and hence has to be poured hot. The goods have to be buffed and polished for a high finish. There is no ornamental work upon them. We have been having a good deal of trouble with blow holes and small defects in castings which show up when they are finished. Could you advise us the best composition for work of this class or state what course to pursue to remedy our difficulty?

Answer.—Spray the molds with molasses water before flouring, place on the floor open, and just before pouring time skin dry with a gasoline torch. Torch the molds to a nice brown; do not burn, close, and pour immediately. Boys could be hired to do this work.

If you are doing this, try the addition of ¼ oz. aluminum, to each 20 lb. pot of dip metal. C. VICKERS.

CASTING OF BRASS LINER.

Question.—The writer was called upon recently to make a brass liner 20 in. in diameter, 30 in. long; the metal being ½ in. thick. It was made in a skin dried mold, using five parts of sharp sand, five parts of red sand, five parts of black sand and one part of flour. The mold was blackened with plumbago and molasses water. The results were a spongy casting on the drag side, while the cope side was firm and solid. I poured it from the end, gatting it from both sides and setting the flask at an angle of about 30 degrees. I am sure that the mold and core were perfectly dry, and if that is the case, why should the drag side come out spongy?—G. J. B.

Answer.—Spongy castings are generally the result of mismanagement in melting. It does not make a particle of difference whether the mold is dry or green, if the metal is abused when in the furnace.

In this case it may be the manner in which the casting was made that caused the trouble. I always make such liners upright, pouring with two pots and gating at the bottom and taking off two heavy risers from the corners of flask opposite to the pouring heads. It is unnecessary to face and dry such a mold and quite often the core is of green sand also. The metal must not be poured hot, and it should contain zinc and be properly melted.

C. VICKERS.

A MIXTURE FOR SLEIGH BELLS.

Question.—Can you give me a good mixture for sleigh bells and chimes?

Answer.—For sleigh bells the following are good mixtures: First, copper, 80 pounds; tin, 20 pounds, zinc, 3 pounds; second, copper, 64 pounds; tin, 12 pounds; zinc, 2 pounds.

METALLURGICAL NOTES.

BY L. G. BLUNT

IRON HIGH IN GRAPHITE.

Question.—T. S. D. states that he is running heats of twenty-five tons per day of one class of iron, but sometimes he needs two or three tons of iron that contain a large percentage of graphite to withstand a high temperature, and that he cannot get this by putting in a special charge, with certainty owing to the influence of the ordinary iron. Therefore he would like to know whether he can add some alloy to the ladle, which would increase the graphite carbon.

Answer.—If the ordinary iron is high in total carbon and low in silicon, the percentage of silicon may be increased by adding ferro-silicon, which has been previously melted in a crucible to the ladle, while the cupola is being tapped, or by placing the solid ferro-silicon in the runner of the cupola so that the iron will absorb it as it flows by. In the former case I should advise using about a ten per-cent alloy and in the latter a seventy-five per-cent.

The iron should be heated to as high a

temperature as possible in the cupola. If the addition of the ferro-silicon should cool the iron too much it may be reheated by the addition of alumino-Thermit. The reduction of carbon due to this reagent would be very small.

If it is low total carbon iron your correspondent is making, I do not know of any reagent to add to the ladle that will materially increase the total carbon.

In such a case the special iron should be the first that is taken from the furnace.

Method of Charging Cupola.

Let the coke bed extend about twenty-seven inches above the top of the upper tuyeres. The weight of the first charge of iron should be five times the weight of the coke above the tuyeres. The succeeding charges should be seven pounds of metal to one of coke. Let the blast pressure be nine ounces twenty minutes after the blower is started. (I assume that your charging door is sixteen feet above the tuyeres). If it is not desirable to run such a high coke bed throughout the heat, it may be readily cut down at any time by increasing the blast to about eighteen ounces, or the total carbon may be reduced by the addition of a large percent of steel.

Iron Mixture.

Seventy-five percent of pig metal which analyzes about 1.75 percent silicon, .02 percent S, below .6 percent P, .6 percent Mn, T. C. above 3.60 percent and 25 percent scrap of about the same analysis except the sulphur; that being about .08 percent. Pour the iron as hot and as fast as the mold will permit. I assume that your coke contains about one percent sulphur. L. G. BLUNT.

SPONGY PARTS.

Question.—What is the cause of the spongy spot in the hub of the accompanying wheel, and what should be done to prevent its occurring again?

Answer.—The cause of this spongy part is the design of the feeders. These feeders were 250 m|m (9⅞ inches) diameter at the top and 80 m|m (3 3-16 inches) at the bottom This small area at the bottom sets long before the casting and in such a case a draw-hole is sure to form some place in the casting when low total carbon iron is used.

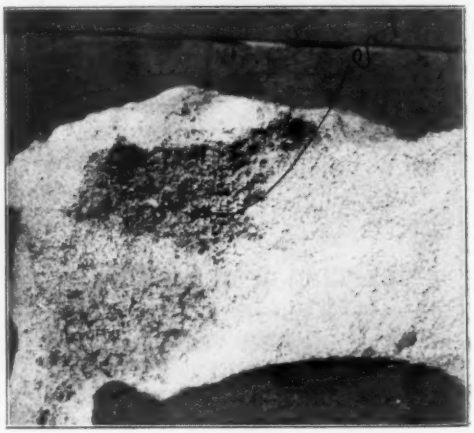
To remedy the formation of this defect I should advise your correspondent not to use the risers on the hub for down gates. The risers should be 110 m|m × 250 m|m at the junction with the hub, and 200 m|m × 300 m|m at the top. The wheel should be made from centres 4 decimetres apart. The parting core may be made in four slabs and

SECTION BROKEN FROM WHEEL.

should extend about one metre out from the centre on one side.

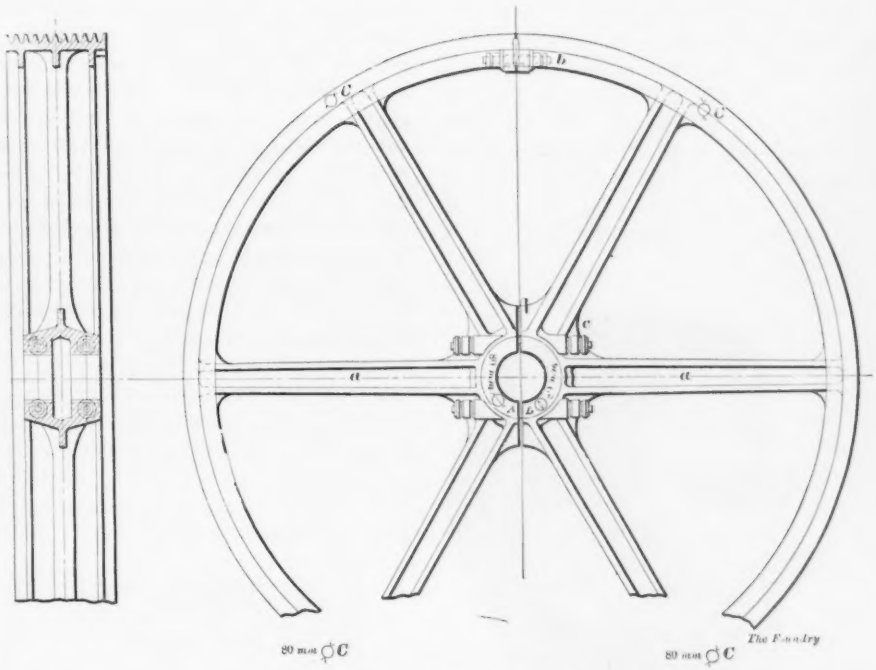
The iron may enter at such a point and run diagonally to the bottom of the hub between the two center slabs. By gating in this manner the runner box will not interfere with the risers.

Cut flow-offs from the rim risers about 100 m|m above the surface of the casting.



ENLARGED VIEW OF SPONGY SPOT.

After pouring, close the flow-offs and put a little blackening in each riser. Add a little hot iron to each riser every few minutes, stir and scrape the plastic iron from the sides,



WHEEL WITH SPONGY SPOTS.

but do not push the feeding rod into the casting. The bolt holes through the hub should be cored out. The maker of this wheel states that the iron used contains 1.17 percent P. I should advise him not to let the phosphorus be above .6 percent, as this element causes cold shortness.

L. G. BLUNT.

TRADE PUBLICATIONS.

It has been said that the prosperity of any district can be judged, to a large extent, by its newspapers. There was a time when there was not mechanical interest enough in the entire South to support a mechanical paper. Through the last few years, however, manufacturing interests have increased very rapidly in a number of the Southern states, and this material development has called into existence a new paper called the *Practical Machinist*, of Atlanta, Ga. It is a monthly paper, devoted exclusively to iron and steel working, machine construction and repairing, etc. It gives special prominence to Southern industries. The paper is published by The Machinist Publishing Co., at the head of which is Mr. J. A. Rasbury, who has long been well known as the business manager of Dixie.

GENERAL INDUSTRIAL NOTES.

The Central Foundry Co., of Milwaukee, Wis., has been incorporated with a capital of $10,000, the incorporators being: Daniel Walsh, S. Edward Smith and Alex. E. Martin.

The Perry Stove Co., of the Borough of Queens, has been incorporated with a capital of $50,000. The directors are: Albert Rathbone, Arthur H. Van Brunt and W. M. Wilson, New York city.

The American Skein & Foundry Co., of Racine, Wis., has opened an office in Columbus, O., with William D. McCullough as State agent. The affairs of the American Skein & Foundry Co. have been in a more or less unsettled condition for some time, but the different interests have now come to an understanding. Some have sold their stock to others, and the following officers have been elected: W. F. Walker, of Chicago, president; Gilbert N. Prentiss, secretary and general manager, and Mr. Mitchell, treasurer.

The Western Steel Gate Co., of Two Rivers, Wis., recently purchased the Duncan Foundry, of Green Bay, Wis., and is rapidly getting it into shape for manufacturing its specialty and also to carry on a general foundry business.

PERSONALS.

Mr. John C. Bradley, of Buffalo, N. Y., has tendered his resignation as general superintendent of the plants of the Pratt & Letchworth Co., of that city. Mr. Bradley has accepted the position of general manager of the Denver Chemical Mfg. Co., of New York, and goes to that city on the first of October to assume the new duties of his important position.

J. C. BRADLEY.

In speaking of this change to one of the representatives of *The Foundry*, Mr. Ogden P. Letchworth, president of the Pratt & Letchworth Co., says: "Mr. Bradley came to our company nearly eight years ago, being formerly superintendent of the Walter A. Wood Co.'s Malleable Iron Works, of Hoosick Falls, N. Y. I consider him the most competent metallurgist, along the lines of malleable and steel castings work of any man I have ever known. He possesses great executive ability and has a most charming and agreeable personality. Upon the death of a brother of Mr. Bradley a short time since, he was left executor of an estate that held interests in the Denver Chemical Mfg. Co., and in order to discharge the obligations of this office as administrator, it became necessary for Mr. Bradley to devote a great deal of time to its duties. It was with much regret that we accepted his resignation as superintendent. I flatter myself that Mr. Bradley is as sincere as ourselves in saying that this severing of relations is as contrary to his own personal preferences as it is to our company, and the only thing that reconciles me to it is the hope that in the business in which he is to take so important a position, the financial returns will fully compensate him."

Mr. C. W. Sherman, of Pittsburg, Pa., has accepted a position as superintendent of the Pratt & Letchworth Co.'s Buffalo plant, to go into effect on the first of October. Mr. Sherman is a recognized metallurgist and has had wide experience in managing large plants.

C. H. Green, formerly of C. H. Green & Co., of Syracuse, N. Y., has associated himself with the S. Obermayer Co., of Chicago, as superintendent of the department which manufactures snap flasks, floor rammers, bench rammers, etc. The Obermayer Co. at its Chicago plant has added a large wood working department with special improved machinery to facilitate prompt shipments of flasks of all kinds.

Wm. Davis has taken charge of the Newcastle Foundry, at Newcastle, Ind.

Mr. J. J. Casey, who for the past nine years has been superintendent of the Haskell & Barker Car Works, at Michigan City, Ind., has accepted a position as superintendent of the Jeffersonville plant of the American Car & Foundry Co.

Mr. R. S. Cooper, former representative of the Rand Drill Co., at Pittsburg, Pa., has been appointed manager of the New York office of the Independent Pneumatic Tool Co., whose head office is at Chicago, Ill. The company's New York office is at 170 Broadway.

James Savage has taken charge of the brass foundry of the Penberthy Injector Co., of Detroit, Mich.

H. F. J. Porter, M. E., has opened an office in the Metropolitan building, 1 Madison avenue, New York, as a consulting engineer. His special field will be to give advice on general manufacturing and mechanical engineering questions tending to-

ward industrial betterment and to install "welfare work."

Richard Peters, Jr., who has been secretary and treasurer of the Solid Steel Casting Co., Chester, Pa., for about four years, has become associated with the Georgia Iron & Coal Co., at its Rising Fawn furnace, Rising Fawn, Ga.

H. F. Stratton, who has been connected with the principal office of the Electrical Controller & Supply Co., at Cleveland, has accepted the position of New York representative of the same company, with offices at No. 136 Liberty street, New York city.

DEATHS.

Mr. C. E. Mills, of Syracuse, N. Y., proprietor of the C. E. Mills Oil Co., died on Aug. 23, and was buried in Oakwood cemetery, in that city. Mr. Mills was well known

C. E. MILLS.

to all foundrymen throughout the country as a core specialist and manufacturer of core oils and core compounds. He was a 32nd-degree Mason, and was also a member of the Knights of Pythias and of the Royal Arcanum, and a number of other societies. Mr. Mills had been engaged in the manufacture of oils all of his life, and had built up a solid, lucrative and prosperous business. He was 57 years old when he died, and leaves a great many friends, who will miss him greatly. The business will be continued in the same way by his son, Henry E. Mills, who has been business manager for the past 10 years.

A. M. Eddy, secretary and treasurer of the R. M. Eddy Foundry Co., of Chicago, Ill., died at his home in Chicago on Sept. 3. Mr. Eddy was born at Buffalo, N. Y., in 1851, and went to Chicago when only 14 years of age. In 1869 he became connected with the Robert M. Eddy foundry, which was founded by his father and James Gardner in 1865. Later his father became sole proprietor, in 1869, and in 1884 he died. The following year the company was incorporated as the R. M. Eddy Foundry Co., and A. M. Eddy was elected secretary and treasurer, which position he has held ever since. Mr. Eddy's death occurred suddenly, and is attributed to heart disease. It was a shock to his many friends in Chicago and throughout the country.

Francis B. Butts, treasurer of the Madison Avenue Foundry Co., of Cleveland, O., died at his home in Cleveland on Sept. 8, after a brief illness. Mr. Butts was born in 1844, and during the Civil War served in both the army and the navy. He was on board Ericson's Monitor on its last trip, and was the last man to leave the boat when it was abandoned and sunk off Cape Hatteras.

Frederick A. Campbell, who was vice president of the United Engineering & Foundry Co., of Pittsburg, Pa., died on Aug. 25, from paralysis. Mr. Campbell has been connected with the company since its organization in 1891, and was one of the directors.

Geo. A. Jelley, president of the G. A. Jelley Foundry Co., of Pittsburg, Pa., died at his home on Aug. 19, as the result of injuries which he had received in his foundry on the preceding Thursday. While directing the work of some of his men, he became wedged between a car and a wagon. His side was crushed and he received internal injuries. Mr. Jelley was 64 years of age.

FIRES.

The Hansell-Elcock Co., of Chicago, Ill., sustained a serious loss from fire on the night of Sept. 8. The loss is variously estimated at from $40,000 to $60,000, a large proportion of which was on the patterns.

The loss is partially covered by insurance.

The foundry of Lartz & Tuecher, at Utica, N. Y., was damaged by fire to the extent of $2,500 on August 23.

Strickland Bros.' machine shops and foundry, at Tuscaloosa, Ala., were destroyed by fire on August 24, entailing a loss of $60,000.

NEW CONSTRUCTION.

The Brown & Sharpe Mfg. Co., of Providence, R. I., is doubling the size of the foundry which was erected two years ago and has also added four stories to the height of the pattern storage building, making it six stories in all.

The plant of the Worcester Steel Foundry Co., of Millbury, Mass., is being enlarged under the direction of G. F. Chase.

The Grieme estate is erecting a small brick addition to the Perkins foundry, of Amsterdam, N. Y. The addition will be 40 x 20 ft.

The E. R. Allen Foundry, of Corning, N. Y., is being enlarged by the construction of a 26 x 60 ft. frame addition.

The Bagley & Sewall Co., of Watertown, N. Y., is building an addition to its foundry, 30 x 140 ft.

The Connellsville Machine & Car Co., of Connellsville, Pa., whose plant was destroyed by fire some time ago, states that it expects to rebuild in the near future.

The Miller Lock Co., of Philadelphia, Pa., is having a two-story foundry building, 47 x 50 ft., constructed at the corner of Melrose and Duncan streets, at a cost of $6,600.

Wm. Steele & Sons, of Philadelphia, Pa., have been granted permits to erect two foundry buildings, one two stories in height and 36 x 150 ft., and the other one story in height, 46 x 150 ft., for Schaum & Uhlinger. The buildings will cost $35,000.

The new foundry of the Reading Iron Co., of Reading, Pa., is rapidly approaching completion and will soon be under roof.

The Fulton Foundry & Machine Works, Wellsville, O., operated by the Stevenson Co., has been erecting new buildings, consisting of a machine shop 58 x 132 ft. and a foundry 60 x 120 ft. Two 10-ton electric traveling cranes have been installed as well as motors for the individually driven machines. The American Bridge Co. is building the structures.

The contracting firm of Kimmell & Hartzell, of Bellevue, O., has secured the contract for the carpenter work for the new foundry building of the Ohio Cultivator Co., to be erected in that city. The main building will be 76 x 250 ft., with an annex 30 x 40 ft.

The Aetna Foundry & Machine Co., Warren, O., is to build an addition to its main building and will install new machinery for both its machine shop and foundry.

The new foundry building to be erected by the Twentieth Century Heating & Ventilating Co., Akron, O., is to be a thoroughly modern one, 86 x 300 ft. The company has about seven acres of land and is well equipped with power apparatus and protective facilities. It is expected that the new foundry will be ready for occupancy Jan. 1, 1906.

A building permit has been granted to the United Engineering & Foundry Co., of Youngstown, O., for the construction of a new building to cost something over $2,000.

The Deming Pump Co., of Salem, O., will erect a large storage building for taking care of the core boxes, iron flasks, etc., used in the foundry. Thus far one division of the foundry building has been used for this purpose, but the large amount of work on hand makes it necessary to use every available portion of the foundry for the work for which it was intended.

The Colonial Brass Co., of Geneva, O., recently purchased buildings from the Geneva Automobile Co., and is remodeling them to suit its purpose, one of the buildings being remodeled for a foundry.

The Vulcan Foundry Co., of Hamilton, O., has broken ground for a new foundry.

The Cincinnati Iron Fence Co., Cincinnati, O., has just purchased property on which it will erect a new foundry, 110 x 200 ft. Considerable new equipment will be purchased and the work will be undertaken at once.

The Ohio Foundry Co., of Cleveland, O., will erect an addition to its plant, the contract having already been let.

The Central Foundry Co., of Vincennes, Ind., is making several additions to its plant, including an addition to the machine shop, 20 x 30 ft., and the partitioning off of a portion of the iron foundry for use as a brass foundry and brass finishing room.

The Ban Foundry Co., of Chicago, Ill., has taken out a permit for a one-story brick foundry to be erected at 876-886 Carroll avenue, at a cost of $5,000.

The Rockford Mfg. Co., of Rockford, Ill., is planning to double the capacity of its foundry by constructing additions this fall.

A contract has been let for the erection of a foundry building in Maywood, Ill., for the John Featherstone Co., the structure to cost about $40,000.

Cooke Bros., of Traverse City, Mich., are constructing buildings for a new iron and brass foundry in that city. One of the buildings is 30 x 150 ft., and is to be used as a foundry, and the other is 30 x 50 ft., to be used as a machine shop.

Bartlett, Hayward & Co., iron founders, of Baltimore, Md., whose plant is at Scott and McHenry streets, have acquired additional territory adjoining their property and will enlarge their plant.

H. H. Smith, of Lodi, has purchased property in Passaic, N. J., and intends to erect an iron foundry which will employ about 100 men.

It is reported that the Central Foundry Co., of Baltimore, Md., is planning to erect a new pattern shop at its plant at Dundalk, Md., near Baltimore. The building will be 50 x 100 ft. and three stories high.

The Crossley Mfg. Co. has taken out a building permit for the construction of a two-story brick pattern shop at East Trenton avenue and Monmouth street, Trenton, N. J.

A permit has been taken out by the American Machine Co., of Louisville, Ky., to build two additions to its foundry plant, one of which will be a one-story building 42 x 160 ft., and will be used as the main foundry building. The other building will be two stories in height and 26 x 36 ft., and will be used as a finishing department.

It is reported that Strickland Bros., of Tuscaloosa, Ala., will rebuild their plant which was recently destroyed by fire.

The Western Steel Car & Foundry Co. is rebuilding the malleable foundry in connection with its plant at Anniston, Ala. This plant was destroyed by fire several years ago, and it is stated that the company now expects to spend $50,000 in rebuilding it and putting it in the best possible condition.

The Sodemann Heat & Power Co., of St. Louis, Mo., is planning to build a foundry and boiler factory in Edwardsville, Ill.

The Davenport Foundry & Machine Co., of Davenport, Ia., will construct a two-story brick building to be used in connection with the foundry department of the plant. It is also making several other additions, including the construction of a new pattern shop.

Chas. Palm, of Sacramento, Cal., is constructing a new foundry 130 x 150 ft.

Geo. B. MacDonald, proprietor of the Longview Iron Works, of Longview, Tex., is planning to build an addition to his foundry, 50 x 100 ft.

The Fulton Iron Works, of San Francisco, Cal., intend to build a new foundry.

GENERAL INDUSTRIAL NOTES.

The Budell Machine & Foundry Co., of New York city, has been incorporated with a capital of $10,000. The incorporators are: Frank Brookfield, 220 Broadway; John H. Thompson, Jr., 60 Wall street, and Henry M. Brookfield, Ardsley-on-Hudson, N. Y.

The Gould-Welden Co., of the Borough of Queens, N. Y., has been incorporated with a capital of $5,000, to do a general machine shop and foundry business. The incorporators are: Frank, A. C. and Almira S. Gould, No. 133 Twelfth street; Samuel T. and Mary Welden, No. 60 Seventh street, all of Long Island city.

The Fort Pitt Malleable & Gray Iron Co., McKees Rocks, Pittsburg, recently completed the erection of a new pattern shop and pattern storage house. It is also building a 50 x 150 ft. core room, the new additions enabling the company to increase its capacity to 10,000 tons of malleable castings annually.

Walter F. Buckley has bought out the brass foundry formerly conducted by Robert Schoenewald, at 627 Filbert street, Philadelphia, Pa. Mr. Buckley has been foreman for Mr. Schoenewald for 13 years, and the business will be continued without interruption.

The property of the Reading Foundry Co., Ltd., of Reading, Pa., was sold to Charles H. Schaeffer at sheriff's sale for $27,000 on Aug. 19. The property includes pipe foundries, machine shop, general foundry, etc., including tools, patterns and all equipment.

The General Castings Co., formerly at Pittsburg, has moved its offices to the works at Verona, Pa.

The North Lebanon Foundry Co., of Lebanon, Pa., announces that it has its new plant for the manufacture of machinery castings, including loam, dry sand brass castings, now in operation. The officers are: Samuel P. Rank, president; John H. Walborn, secretary, and A. W. Patschke, treasurer and superintendent.

The Bucyrus Steel Casting Co., Bucyrus, O., of which mention was made in our last issue, has elected the following directors: P. J. Carroll, F. P. Donnenwirth, A. M.

Rumer, Geo. Donnenwirth, Jacob Colter, J. A. Chesney and W. A. Blicke. The officers are P. J. Carroll, president and general manager; F. P. Donnenwirth, vice president, and W. A. Blicke, secretary and treasurer. The company is looking for a site intending to build at once and install its machinery.

The Dayton Vulcan Foundry Co., of Dayton, O., has been incorporated with a capital of $10,000. The incorporators are: Hugo Cook, M. W. Chambers, William F. Miller, W. W. Bishop and H. F. Nolan. It is reported that the new company will occupy the old plant at the corner of Ludlow and Bayard streets, which is at present occupied by the Dayton Foundry Co., and that it is practically a reorganization of the old company, with added capital.

The plant of the American Foundry & Machine Co., of Ravenna, O., has been sold to Albert C. Hays, of Pittsburg, who will organize the Reeves Centrifugal Engine Co., for the manufacture of steam, gas and gasoline engines.

The Wilks Foundry Co., of Toledo, O., have secured the services of Mr. James Brady, of Chicago, to take charge of their light work foundry, and C. Y. Nellis, of Seneca Falls, N. Y., to take charge as foreman of their heavy work shop. Under this arrangement Mr. Brady, with his foreman, will look after the light shop and Mr. Wilks with Mr. Nellis as foreman, will look after the interests of the heavy shop.

The property of the former Ideal Foundry Co., of Ashtabula, O., has been sold to Oscar C. Evans, of Cleveland, O., who will take possession at once and prepare the plant for operation.

The Haven Malleable Castings Co., Cincinnati, has increased its capital stock from $75,000 to $100,000.

Mrs. Bernard Madden has purchased the interest of Thos. Madden in the firm of Madden & Co., of Rushville, Ind. The business will be continued under the firm name of Madden & Co., with Bernard Madden, Sr., in charge of the foundry; Bert, Lawrence and Frank Madden conducting the machine department, and Theresa Madden the office.

The Newcastle Gray Iron Foundry, of Newcastle, Ind., which has been closed for several years, has resumed operations with the prospect of good business ahead.

The Bedford-New York Foundry Co., Bedford, Ind., has been incorporated with $100,000 capital stock. The incorporators are: Frederick D. Norton, Clinton S. Norton, Robert Reed, S. P. Reed and Spencer K. Norton.

The Oregon Foundry & Machine Co., Oregon, Ill., has as the result of largely increased business increased its capital to $20,000, and placed orders for considerable equipment.

The Wilcox Mfg. Co., of Aurora, Ill., has had to gradually increase the capacity in the overhead trolley track department by enlarging the plant and installing new and special machinery. It also expects to engage in the manufacture of all types of cranes. At the head of the engineering department has been placed C. F. Blake, a member of the A. S. M. E., who was formerly associated with the Shaw Electric Crane Co., Muskegon, Mich. The combination of all types of modern cranes with the overhead trolley track business will enable this company to figure on equipment for transporting "anything anywhere any time."

The McIntosh Foundry & Machine Co., of Monmouth, Ill., met on Aug. 22, and elected the following officers: President, A. D. McIntosh; vice president, J. F. Duffin; secretary, F. M. McIntosh; treasurer, W. A. Miles.

The Rock River Mfg. Co., of Dixon, Ill., has commenced work again, and believes that the plant will continue in operation throughout the rest of the year.

The Wm. B. Anderson Foundry Co., of Chicago, Ill., has been incorporated with a capital of $5,000, to engage in the manufacture of brass castings.

The plant of the Walsh Brake Shoe & Foundry Co. has been moved from Chicago to Rock Island, Ill.

Adrian Steel Casting Co., Adrian, Mich., manufacturer of crucible steel castings, has undergone a complete reorganization and has made large improvements about its plant. The election of officers recently resulted as follows: George B. M. Seager, president; S. S. Withington, vice president; B. M. Gardner, secretary, and E. N. Smith, treasurer.

The South foundry of the Allis-Chalmers Co., at Milwaukee, Wis., which has been idle for some time, is now in operation and giving employment to 500 men.

The Day Stove & Foundry Co., of Bessemer, Ala., has been incorporated with a capital of $10,000, the officers being J. R. Day, president; Pinkney Scott, vice president; Geo. L. Scott, secretary and treasurer, and J. A. Fitzgerald, manager. The company will manufacture grates and castings of all kinds and the plant will be considerably enlarged.